CIVIL ENGINEERING

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RESEARCH

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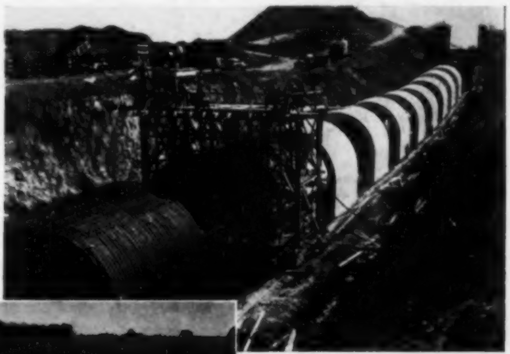
CANALS



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AMERICAN SOCIETY OF CIVIL ENGINEERS FOUNDED 1852

• see article by

Kenneth Markwell

BIG NEW BUILDINGS IN PITTSBURGH'S GATEWAY CENTER

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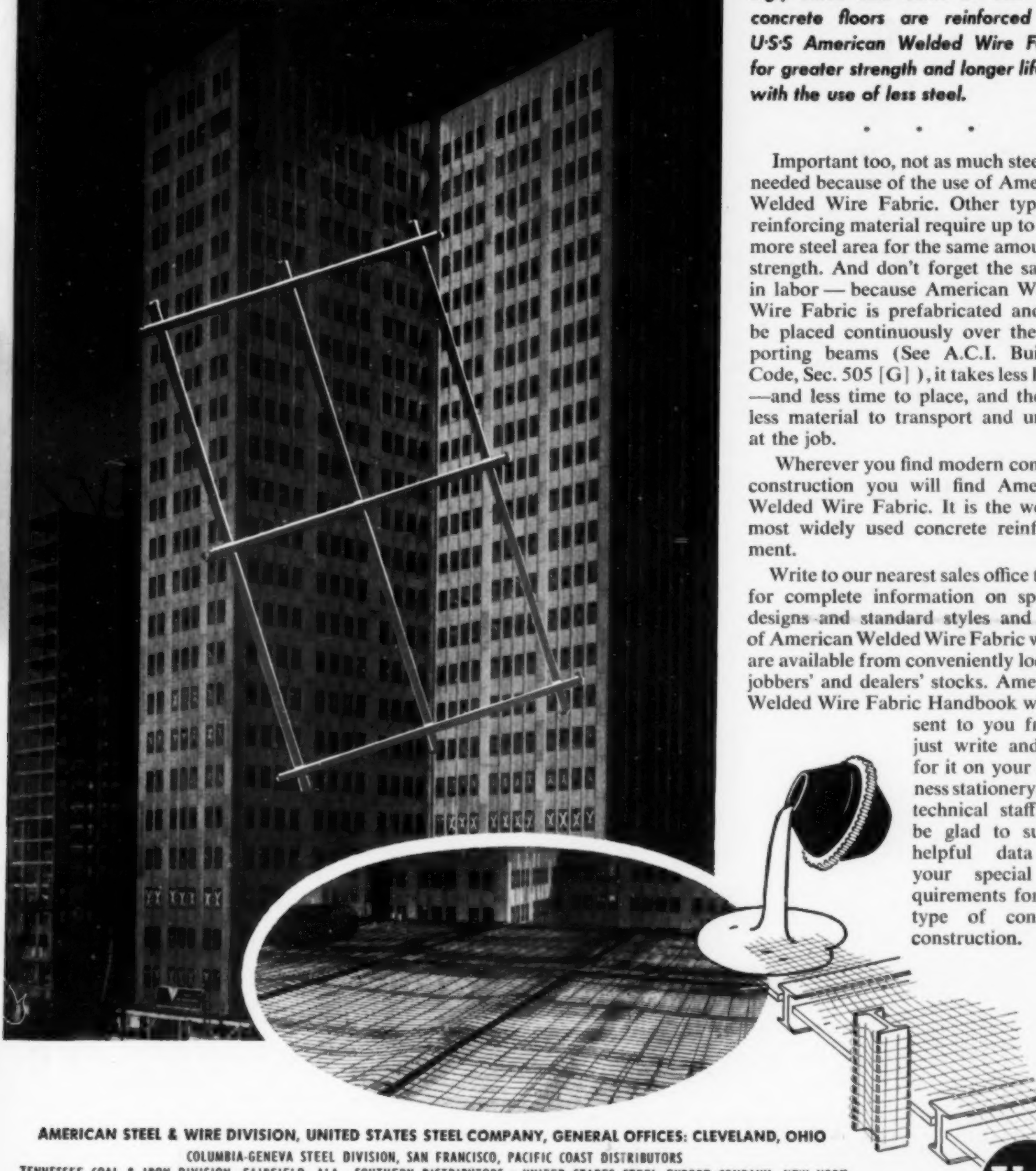

One of the most dramatic developments in city planning is the new Gateway Center in Pittsburgh's Golden Triangle. In these fine, modern buildings, acres and acres of short span concrete floors are reinforced with U·S·S American Welded Wire Fabric, for greater strength and longer life and with the use of less steel.

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Important too, not as much steel was needed because of the use of American Welded Wire Fabric. Other types of reinforcing material require up to 28% more steel area for the same amount of strength. And don't forget the savings in labor — because American Welded Wire Fabric is prefabricated and can be placed continuously over the supporting beams (See A.C.I. Building Code, Sec. 505 [G]), it takes less hands —and less time to place, and there is less material to transport and unload at the job.

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Write to our nearest sales office today for complete information on specific designs and standard styles and sizes of American Welded Wire Fabric which are available from conveniently located jobbers' and dealers' stocks. American Welded Wire Fabric Handbook will be sent to you free—just write and ask for it on your business stationery. Our technical staff will be glad to supply helpful data on your special requirements for any type of concrete construction.

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EVERY TYPE OF REINFORCED CONCRETE CONSTRUCTION NEEDS

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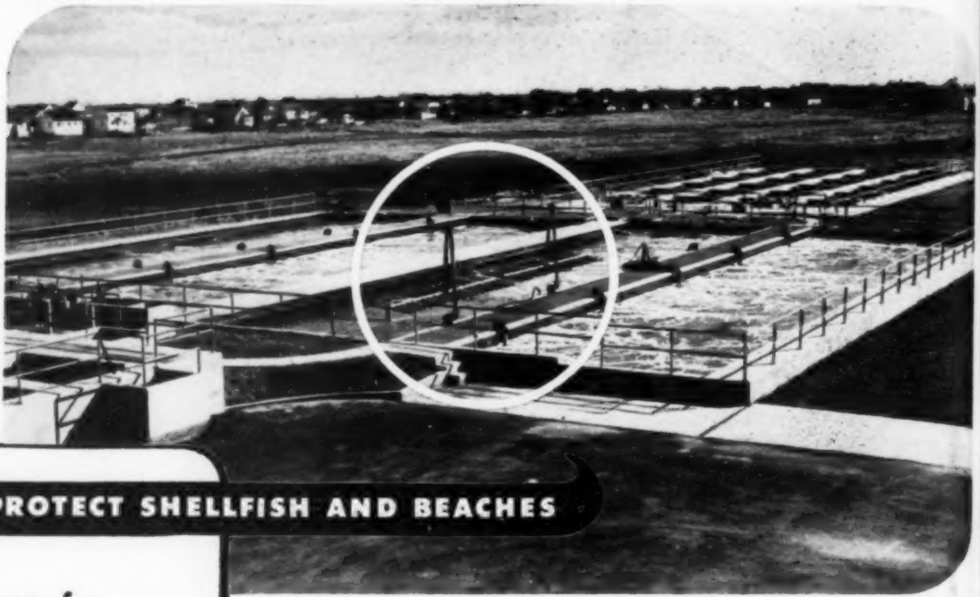

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Engineers for FAIRFIELD, CONN. Choose

CHICAGO AIR-DIFFUSION SYSTEM

Aeration Tanks, Fairfield, Connecticut Sewage Treatment Plant, with Chicago Swing Diffusers and Precision Diffuser Tubes. Air is supplied by three Chicago Standardaire Blowers. Two Blowers are direct connected to electric motors and have a capacity of 2000 cfm each at 6.5 psi. One Blower is direct connected to a gas engine and has a capacity of 2100 cfm at 6.5 psi. Design flow of the plant is 4 M.G.D. Bowe, Albertson & Associates, Engineers.

The City of Fairfield, Connecticut, is assured of continuous and economical operation of the aeration battery in their new Activated Sludge Sewage Treatment Plant. Bowe, Albertson & Associates, Engineers, specified a Chicago Air Diffusion System to provide complete equipment for sewage aeration. Everything necessary from air to water is specifically designed and engineered as a unit to treat sewage and industrial wastes. The Chicago Standardaire Blower, Swing Diffusers and Precision Diffuser Tubes provide efficient, quiet, continuous operation at low cost. Over 100 Chicago Air Diffusion Systems have been specified or installed in Sewage Treatment Plants.

Other Chicago Sewage Equipment makes possible the most economical and efficient operation of the plant. Two Chicago Comminutors cut coarse sewage matter into small settleable solids without removal from the channel. One 10″ and two 8″ Chicago Vertical Open Shaft Non-Clog Pumps handle the raw sewage. Everything was done to provide the City of Fairfield with a Sewage Treatment Plant that would deliver a clear, sparkling effluent. Shellfish beds in Long Island Sound and the recreational aspects of the surrounding waters will not be contaminated.

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Atlanta airport expansion job is scene of new triumph for International power

When C. A. A. district headquarters decided to move to Atlanta, Georgia, the east-west runway at nearby Fulton County Airport had to be extended to 5,000-foot length.

One contractor, C. L. Rhodes of Decatur, Georgia, is doing the entire job, including cutting through a 39-foot hill and moving 350,000 cubic yards of sandy clay.

Rhodes' General Superintendent, R. N. Smith, tells how the work is going:

"We load quicker, haul faster and move more dirt with our Internationals than with any other crawlers.

"Our operators push 'em to the limit all day long to get the job done ahead of schedule. The tractors get clean filters, fuel and grease, and hard work—more hard work than is reasonable—and they take it month after month without a let down!"

That's what International owners everywhere are finding out. Find out for yourself. Ask your International Industrial Distributor for details.

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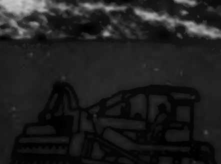
JOHNNY-ON-THE-SPOT SERVICE. A fast field service team from International's Atlanta distributor rolls up to the job site. Service like this from *your* International distributor is as near as your nearest telephone, to cut down downtime and keep your equipment rolling!

HIGH HEAPING FOR HIGH FLYING. Here are three of the five International crawlers that are furnishing power to extend runways at Fulton County Airport to increase the field's traffic potential.



to LEROY ®
was bound to come!

Instead of stencils, the LEROY Lettering Set has templates with grooved characters which guide the pen virtually by "remote control". In place of a hand-held pen, there is a movable scriber. It combines a lettering pen, a pin that fits in and follows the grooved characters, and a sliding pivot, and it holds them in triangular relationship. Because a straight groove in the template restricts the motion of the pivot, the movement of the pen is governed entirely by the movement of the tracer pin.

With the LEROY scriber, the lettering is done above the template where it is always visible and safe from smearing, instead of through a stencil. Each letter, numeral or symbol is formed completely with unbroken lines, without moving the template. Its size and shape are entirely controlled by the template grooves, so that rapid, uniform lettering is easy. By a simple adjustment of the scriber, either vertical or slant lettering is possible from the same template.

With a LEROY Lettering Set, you can draw capitals, lower case letters and numerals from a single template. You can form perfect letters on the first trial, and can develop speed with a few minutes' practice. No guide lines, no "roughing in", no erasing. You can be sure of uniformity throughout the drafting room, in pencil or ink.

There are LEROY templates and pens for every size and thickness of lettering normally required, as well as templates with engineering and scientific symbols and with special alphabets. K&E can also produce special templates for phrases, symbols or trade marks of your own design.

Ask your K&E Distributor or Branch to tell you about other LEROY features, or write to us for complete booklet on LEROY.

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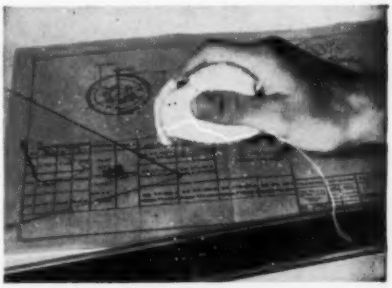
You will find "Quick Set" the handiest large bow combination you've ever used. It has a trigger-quick action for coarse settings plus micrometer adjustment for precise settings. Complete with interchangeable pen and pencil inserts for circles up to 12½" diameter in pencil and 12" diameter in ink.



Cut down on the clean-up with an ABC* Dry Clean Pad. Tiny gum eraser particles sift through the mesh of the pad. Sprinkle them in a light film over the drawing surface before starting work and you'll have no graphite smears. Use it the same way for final clean up. Contains no grit or abrasive.

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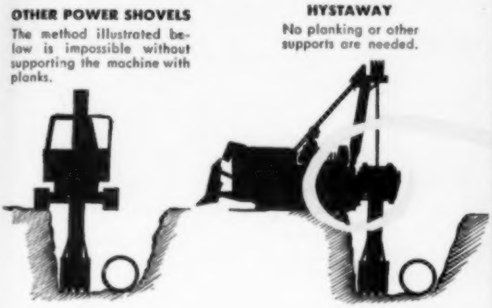
Mud and Mountains are HYSTAWAY'S Dish

Exclusive HYSTAWAY® Design Advantages Pay Off for Pipeline Contractors

Not only was mud and rough mountainous terrain a problem contended with on the pipeline job shown, but in some instances trench excavation had to be accomplished by positioning the machines at right angles to the ditch. (Straddling in the conventional manner was not possible without shoring up, which is costly and time consuming.)

The Hystaway is capable of full production digging in this position and it is the only excavator-crane designed to swing the boom from a point to the rear of the tracks.

The diagram compares the Hystaway swing design to full revolving machines.

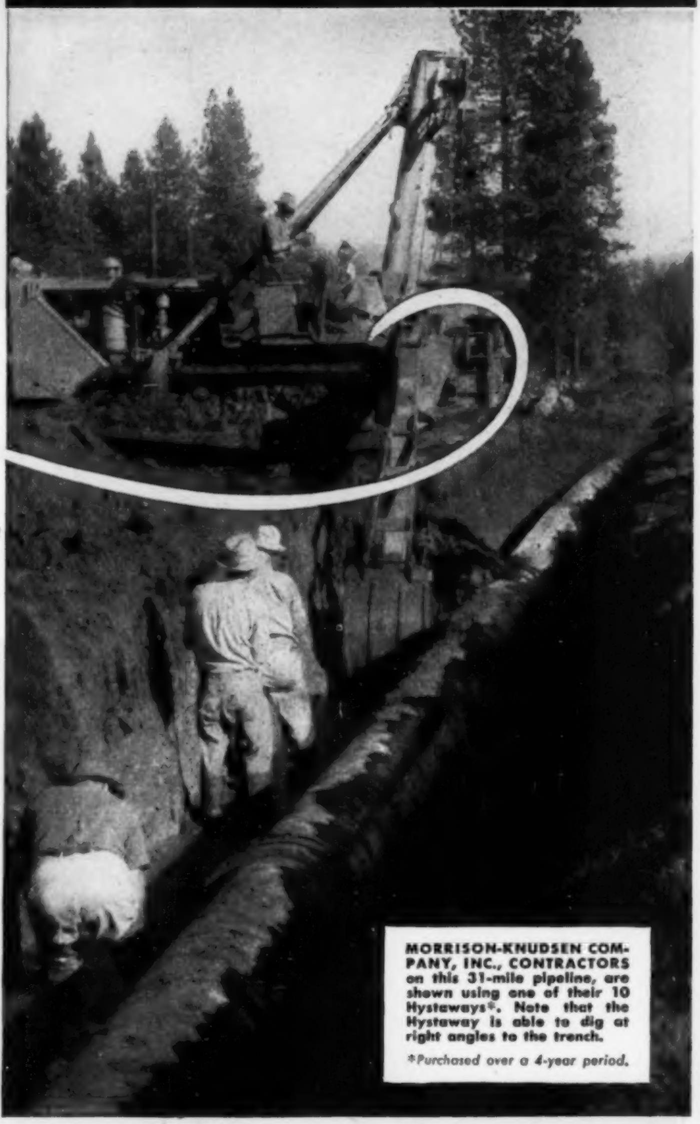


In addition, because the Hystaway mounts on a Caterpillar Track-type Tractor it combines high production excavator-crane work, with full tractor mobility and maneuverability. This permits moves to be made at tractor speeds, through mud, over rocky, mountainous terrain; also makes it possible to get into jobs *unassisted*, work in places inaccessible to other excavators.

The Hystaway can be equipped to operate as a Backhoe, Shovel, Dragline, Clamshell, or Crane. Controls and other operating features are similar to standards set for half-yard excavators.

The Hystaway mounts on Caterpillar D8, D7 and D6 tractors. After initial installation, mounting can be accomplished in approximately 1 hour and demounting in ½ hour. Removal of the Hystaway frees tractor for normal bulldozing, other jobs.

See your Caterpillar-Hyster dealer, or write for literature.



MORRISON-KNUDSEN COMPANY, INC., CONTRACTORS on this 31-mile pipeline, are shown using one of their 10 Hystaways*. Note that the Hystaway is able to dig at right angles to the trench.

**Purchased over a 4-year period.*

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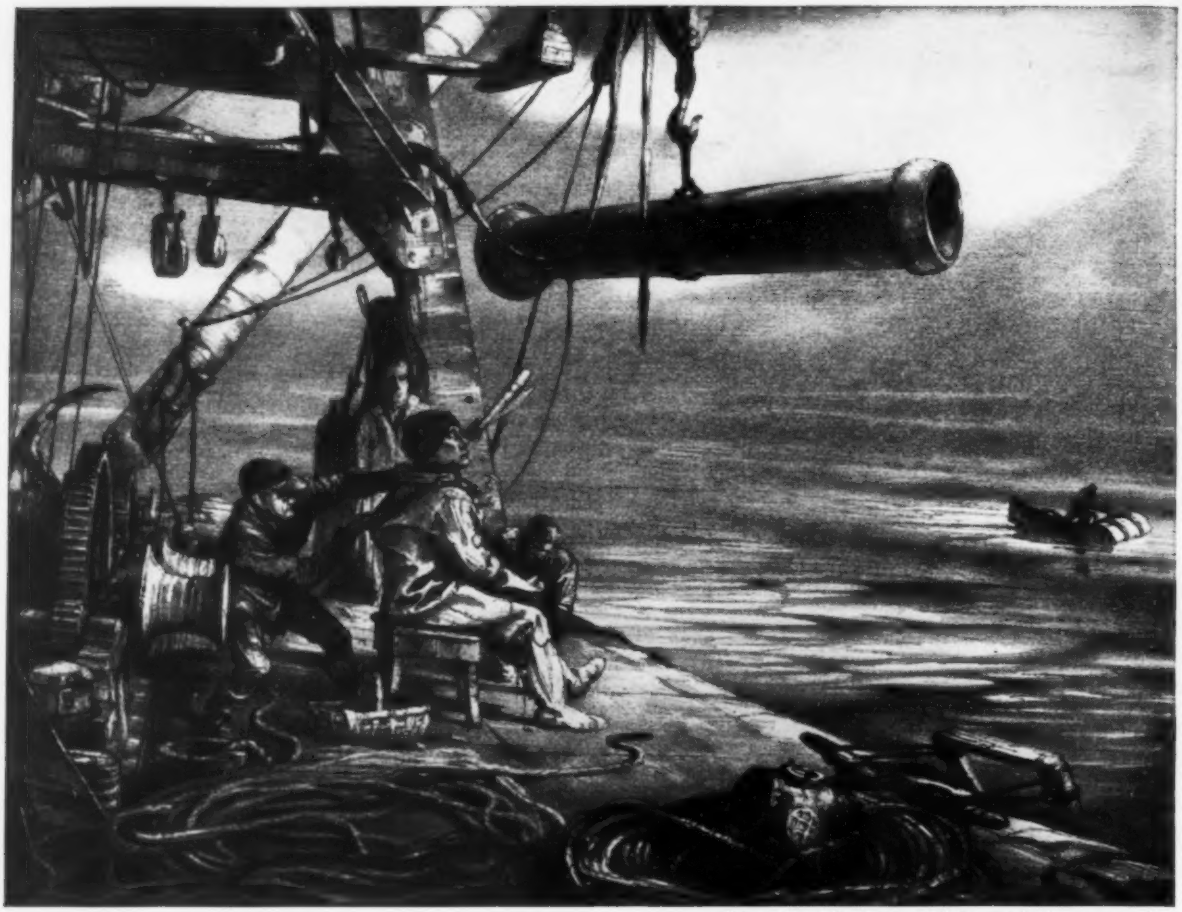

"Dressing The Diver," lithographed on stone for U.S. Pipe and Foundry Co. by John A. Noble, A.N.A.

OUR FLEXIBLE JOINT PIPE is highly regarded by water, gas and sanitation engineers for dependable service in submarine lines. For many years, it has been used in notable and difficult installations throughout the nation.

U. S. flexible joint pipe in all sizes, and pipe 30-inch and larger with other types of joints, are made by the pit cast process. Our pipe, 2-inch through 24-inch, is cast centrifugally in metal molds with bell-and-spigot, mechanical joint or plain ends. All of these types of pipe and joints are widely used for water, gas, sewerage and industrial service and are readily available to meet your requirements.

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To a tax-burdened public the statement that cast iron pipe is the "taxpayers' friend" is more than a mere figure of speech. To most waterworks engineers it is a cold fact. They know that cast iron pipe in water distribution systems has saved, and continues to save, millions of dollars in local taxes.

The useful life of cast iron pipe is known to be 4 to 5 times the average term of a water revenue bond issue. More than 35 American cities have cast iron mains in service that were installed over 100 years ago. A survey sponsored by three waterworks associations shows that 96% of all six-inch and larger cast iron pipe *ever laid* in 25 representative cities, is still in service.

Fortunately for taxpayers, over 95% of the pipe in America's water distribution systems is long-lived cast iron pipe—*the taxpayers' friend.*

This cast iron water main installed in Richmond, Virginia, 120 years ago, is still in service. Over 35 other cities have century-old cast iron mains in service.

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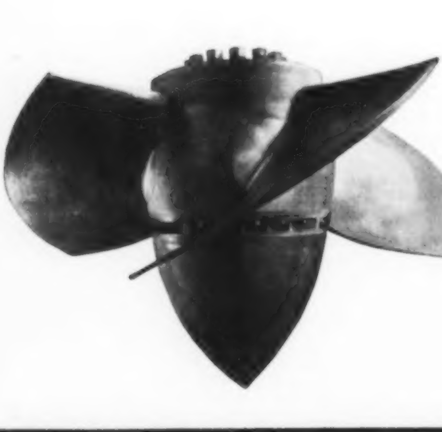

AMPLIDYNE CONTROL—first applied to movable bridges by G.E.—permits raising and lowering Oakland's new Fruitvale bridge in a shorter time than by any other method. Amplidyne control responds instantly, provides faster acceleration and deceleration.

BRIDGE OPERATION is centered in operator's console. Amplidyne's closer control keeps ends of span aligned during operation, "seats" bridge accurately and smoothly.

REDUCED STRESS ON BRIDGE structure and machinery results from torque limiting, inherent in amplidyne control. Photo shows part of G-E drive equipment in east tower.

Smooth, pinpoint control speeds bridge operation

G-E amplidyne-controlled drive prevents skewing, seats span faster, protects structure from shocks

Key to precise control, faster operation, and better equipment protection of Oakland's new Fruitvale Avenue Lift Bridge is its General Electric amplidyne-controlled drive system. Working closely with Woodruff & Sampson, consulting engineers for the Corps of Engineers, Judson Pacific–Murphy Corp., general contractors, and Enterprise Electric Works, electrical contractors, G.E. has again engineered the versatile amplidyne into an outstanding movable-bridge system.

This is but one example of the help G-E engineers can provide *your* engineers or consultants on installed equipment for heavy construction projects. Contact your G-E Apparatus Sales Office. General Electric Company, Schenectady 5, N. Y. 664-23

WORLD'S FIRST amplidyne-controlled lift bridge—pioneered by G.E.—is Stickel Memorial Bridge in New Jersey. Consulting engineers were Hardesty & Hanover.

Engineered Electrical Systems For Heavy Construction

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VOLUME 22

NUMBER 7

CIVIL ENGINEERING

JULY 1952

THE MAGAZINE OF ENGINEERED CONSTRUCTION

EDITORIAL & ADVERTISING DEPARTMENTS
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IN THIS ISSUE

SOCIETY NEWS

NEWS BRIEFS

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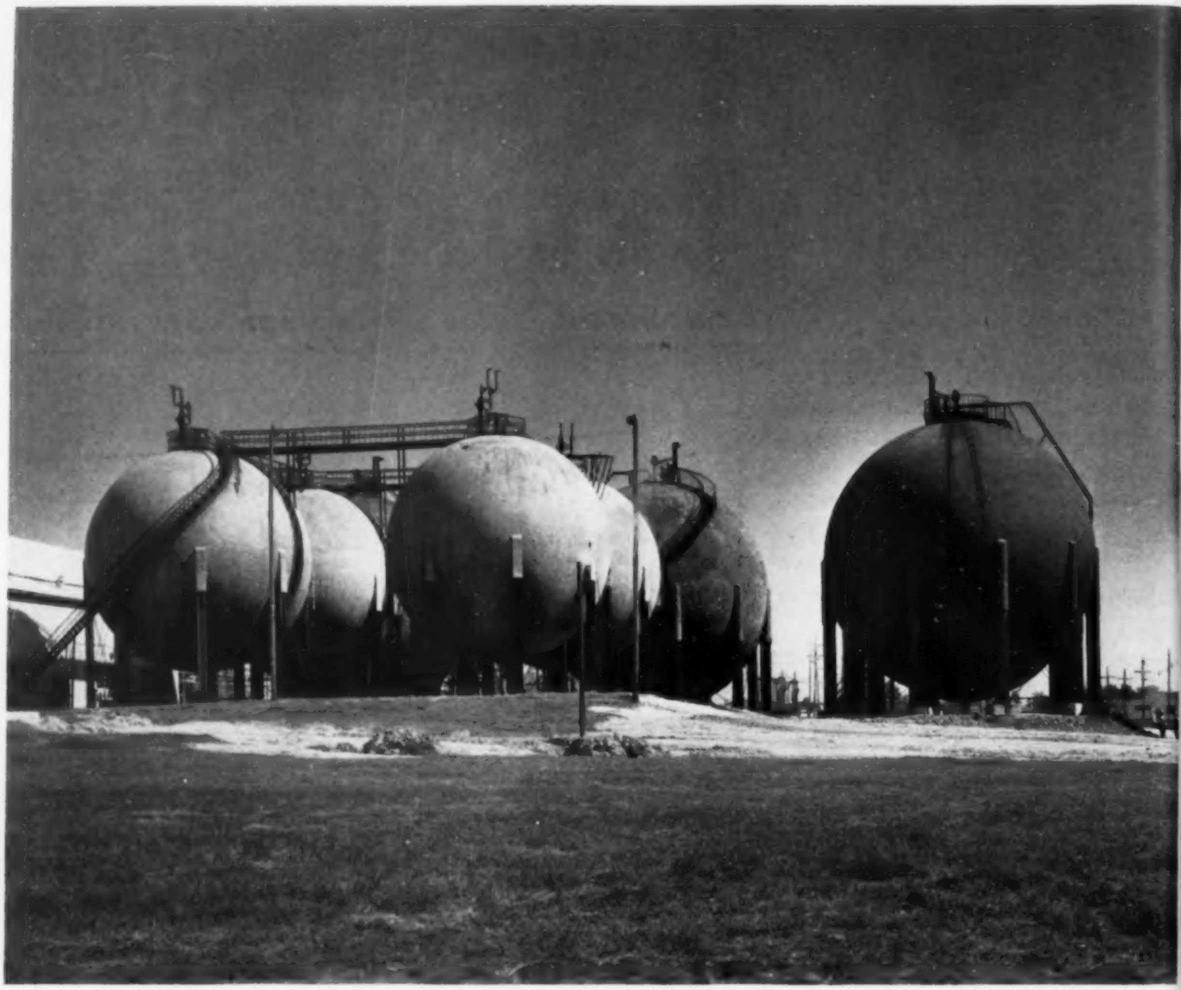

CIVIL ENGINEERING

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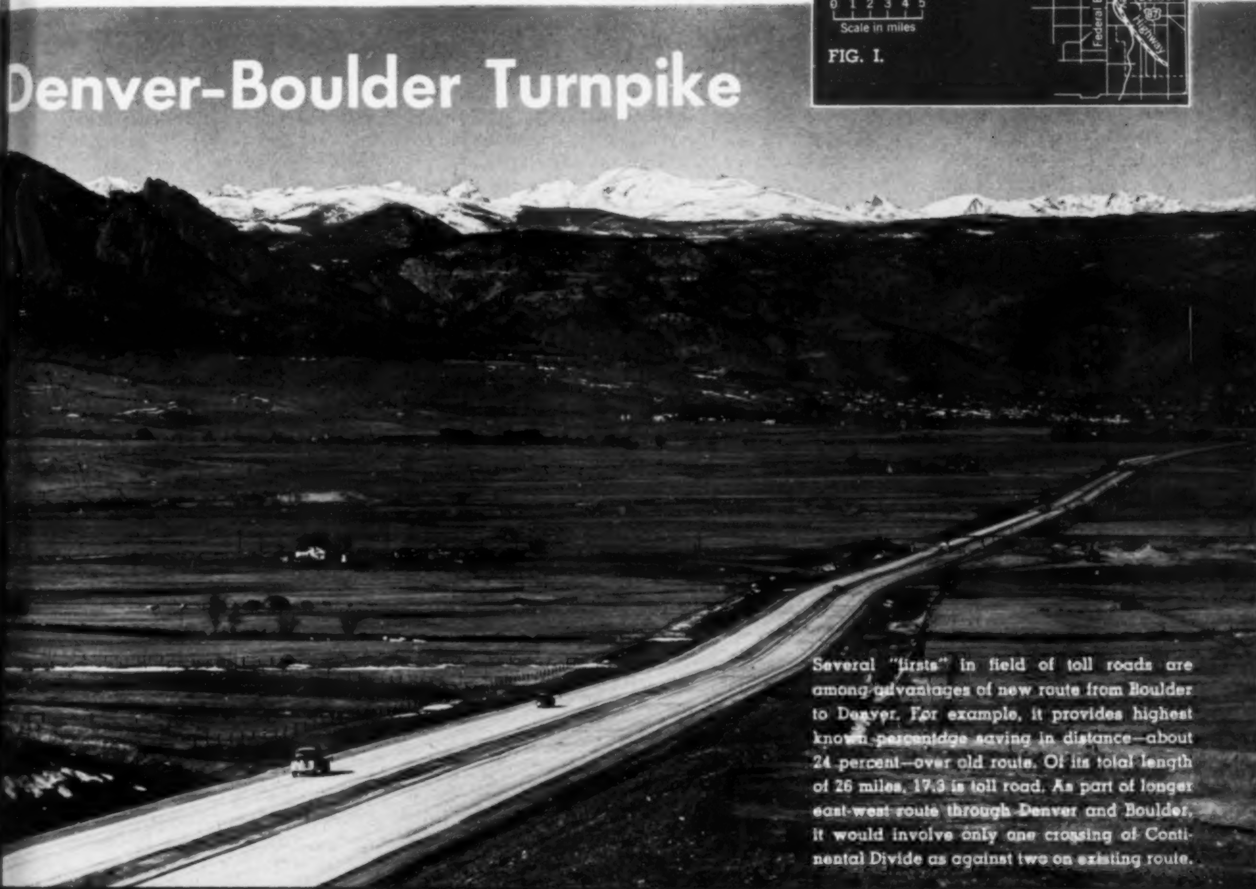
THE MAGAZINE OF ENGINEERED CONSTRUCTION

FIG. I.

Denver-Boulder Turnpike



Several "firsts" in field of toll roads are among advantages of new route from Boulder to Denver. For example, it provides highest known percentage saving in distance—about 24 percent—over old route. Of its total length of 26 miles, 17.3 is toll road. As part of longer east-west route through Denver and Boulder, it would involve only one crossing of Continental Divide as against two on existing route.

Local initiative puts through much-needed toll route

RODERICK L. DOWNING, M. ASCE

Professor of Civil Engineering,

University of Colorado, Boulder, Colo.

Mid-January, 1952, marked not only the opening of the Denver-Boulder Turnpike but also the culmination of 25 years of effort to secure a direct highway between Boulder and Denver. (See map, Fig. 1.) This route was first used by the writer to demonstrate to undergraduate students in highway engineering the principles of highway benefits. The turnpike presents several firsts in its field. So far as can be ascertained, Boulder is the only city in the United States of its size (25,000) that is not located on a primary federal-aid highway. No other toll road in the United States aproaches the percentage saving in distance of this one—8 miles saved in the former travel distance of 34 miles, making the present route 26 miles long, of which 17.3 miles constitutes the toll

road proper. The old road between Denver and Boulder carried more traffic than any other road of similar length in the State of Colorado. Another unique feature of the turnpike is that only one toll collection station is required for its entire length.

It appears fairly certain that the isolation of Boulder from the primary road system of the state will be corrected in the not-too-distant future. As a part of a longer east-west route, the turnpike will connect Denver (and Boulder) with Colorado's largest city in the western part of the state, Grand Junction, with no saving in distance but with less than 25 miles of snow in winter compared to more than 80 miles on the present route. Also, the new route will involve only one crossing of the Continental Divide compared to two crossings on the present route.

State Highway Department Lacks Funds

A preliminary sketch map of the Denver-Boulder Turnpike, together with an economic comparison of costs versus benefits, was presented to State Highway Engineer, C. D. Vail, by the writer in June 1935. At that time the project was quickly eliminated from further consideration on the ground that no money for such a project was available—this in spite of the fact that the estimated distance savings to traffic, then 1,600 vehicles per day, were sufficient to repay principal and interest on the estimated construction cost in a period of 5½ years. Subsequent attempts to bring the project to the attention of the State Highway Department for inclusion in its budget were usually countered with the statement that "If the project is as advantageous as you claim, why don't you organize a company to build it and operate it by collecting tolls?"

In 1937, 1938, and 1939 location surveys were run between Boulder and Broomfield by students under the direction of the writer, as class problems in curves and earthwork. In 1940, the estimated costs of a direct state highway between Denver and Boulder were carefully worked out by the writer and compared with the estimated benefits to traffic ("Highway Economics," 14th Annual Highway Engineering Conference, University of Colorado). Many talks were made before service clubs and other public gatherings to point out the merits of a direct highway. Local papers reporting on these discussions spread the information. The Chamber of Commerce of Boulder, through its highway committee; began to actively support the direct highway. The President of the University of Colorado, together with prominent alumni of the institution in Denver, began to work for its construction by the State Highway Department.

At a meeting in the Denver Athletic Club on June 30, 1946, these groups met with the administrative officers of the Highway Department and the Governor of the State of Colorado. After complete discussion, all present were in agreement as to the desirability of the project. The representatives of the State Highway Department reviewed highway conditions throughout the state and pointed out some of the more critical needs. Since Denver and Boulder were connected by a concrete highway, they did not believe it advisable to use state funds for this construction even though the benefits to traffic were so obvious and the need was so great. Asked when state funds might be available, their answer was that it would be twelve to fifteen years.

Governor Ralph Carr then stated that, in his opinion, the only alternative was to pass enabling toll-road legislation so that the project could be built as a toll road. Robert L. Stearns, President of the University of Colorado, pledged all the facilities of the university to hasten the project and directed me to survey the route if it could be done by students from my classes, so that information on costs of construction could be made available.

Initial Survey Made by Students

Accordingly, my class in highway engineering, consisting of 22 students, made the survey in the summer of 1946. The class was divided into two squads of 11 men each. One squad worked on Saturdays and the other on Sundays so as not to interfere with other class work. Four weekends were required, or a total of eight days, to make the 16-mile survey from Boulder to Federal Boulevard. The State Highway Department agreed to construct the connecting road from Federal Boulevard to the Valley Highway because it would also serve all northbound traffic on U.S. 87-287 as well as Denver-Boulder traffic. The survey notes included alignment, ties to land lines, profile, and cross sections.

The original request for a direct highway between Denver and Boulder was for a two-lane state highway with adequate shoulders so that a disabled car could be stopped off of the traveled way. It must also have such alignment, both vertical and horizontal, as would permit car operation at uniform speeds. The existing road followed land lines on a 66-ft right-of-way. It was surfaced with concrete pavement 6 in. thick and 18 ft wide and was constructed during the period 1923–1928. Curves were not superelevated and radii were very short. Maximum speed permitted on Colorado highways was then 35 miles an hour. Vertical curves were short and many sight distances were less than 200 ft.

While through traffic between Denver and Boulder was less than 1,500 vehicles a day, some of the worst sections of the road were carrying 3,500 vehicles. Included in this traffic were many worn-out trucks used for hauling coal from the Boulder field to Denver. Because of their mechanical condition as well as overloading, these trucks moved up steep grades at speeds as low as two to five miles per hour. As these steep grades occurred where sight distances were extremely short, driver irritation caused many to take chances and accidents were frequent. The State Highway Department was inclined to underestimate the seriousness of our highway difficulties, since many miles of state highway were not even adequately graded or drained, let alone surfaced.

In January 1948, Howard, Needles, Tammen & Bergendoff were engaged to make a study of the economic feasibility of the project. Their report, made on April 1, 1949, indicated that expected revenues would lack some \$86,000 per year of meeting the annual expense of the project. Traffic was estimated on the basis of a joint survey by the Highway Department, the Boulder Chamber of Commerce, and the University of Colorado. A sample of the traffic was interviewed. Forms furnished by the *Boulder Daily Camera* and the Boulder Chamber of Commerce

were filled out by students and townspeople of Boulder to indicate the extent to which they would use the new route. The total traffic forecast from these combined methods was reduced some 40 percent by the engineering firm on the ground that estimates and samples were probably much exaggerated.

Legislation Enacted

The original toll-road legislation presented to the legislature in April 1947 was bitterly contested by two neighboring communities of Boulder. The bill introduced in January 1949 incorporated changes which made it possible for state highway funds to be used up to the limit of 30 percent of the annual cost of the project. This bill was passed and signed by the Governor on April 16, 1949. The legality of the legislation was promptly challenged. To settle this point as quickly as possible, the State Attorney General agreed to accept a directed verdict from the lower court in which the suit was brought. The question was then submitted to the State Supreme Court. After lengthy hearings, the Act was declared constitutional in a decision rendered April 3, 1950.

In May 1950, the firm of Howard, Needles, Tammen & Bergendoff was directed to locate the project on the ground, to determine the location and amounts of right-of-way needed, and to prepare specifications and construction drawings.

Only one bid was received on September 29, 1950, the date set for opening bids for the 6.3 million dollars worth of bonds to be issued. This was a joint bid of six financial firms at an interest rate only slightly below the maximum of 3 percent specified by the legislature. The bid was accepted by the State Highway Advisory Board. The following day, bids were opened for grading and minor structures on the Broomfield-Boulder section of the turnpike. Table I lists the dates, purpose, contractor, and amounts of the various parts of the project. In addition, interest during construction amounts to $330,000 and contingencies and miscellaneous, $217,000. Construction work is still in progress.

TABLE I. Contracts Let on Denver-Boulder Turnpike

Date	Contract	Amount
9-30-50	Grading and minor structures, Boulder-Broomfield Peter Kiewit & Sons' Co.	$1,066,766
12-14-50	Grading and minor structures, Broomfield-Denver J. H. & N. M. Monaghan	696,014
	Structures, Boulder-Broomfield Peter Kiewit & Sons' Co.	257,000
	Structures, Broomfield-Denver J. H. & N. M. Monaghan	344,000
10-19-50	Structural steel Allied Structural Steel Company	224,000
	Reinforcing steel Colorado Builders Supply Company	83,633
	Treated timber piling Nebraska Bridge Company	48,000
2-1-51	Paving, Western Construction Corporation	1,987,000
	Toll house, Hudson Construction Company	74,000
	Engineering, Howard, Needles, Tammen & Bergendoff plus additional fee for supervision	205,000
	Right-of-way	510,000
	Total	$5,505,413

The connecting road from the end of the turnpike at Federal Boulevard to the Valley Highway, 2.5 miles, will be built by the State Highway Department since it will serve all northbound traffic from Denver on U.S. 87 as well as turnpike traffic. The cost of this connection is estimated to be $430,000. In addition, a traffic interchange structure at Federal Boulevard, estimated at $260,000, will be constructed with state highway funds. The terminus of the turnpike, as located by the consulting engineers, was moved about two miles nearer Denver on Federal Boulevard. This increased the length of the turnpike by about 1.3 miles and shortened the State Highway connection from the Valley Highway about the same amount. The connecting road was placed under contract in December 1951 and was not available for use when the turnpike was formally opened to traffic.

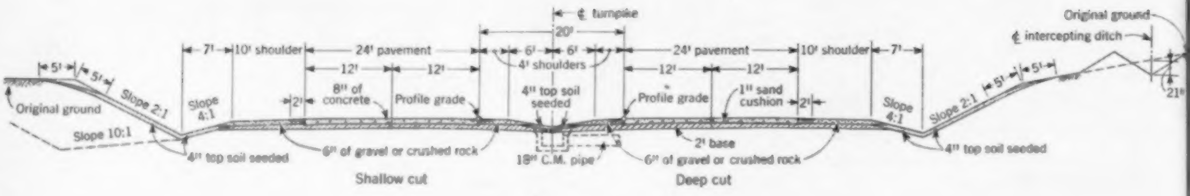
Four-Lane Divided Roadway

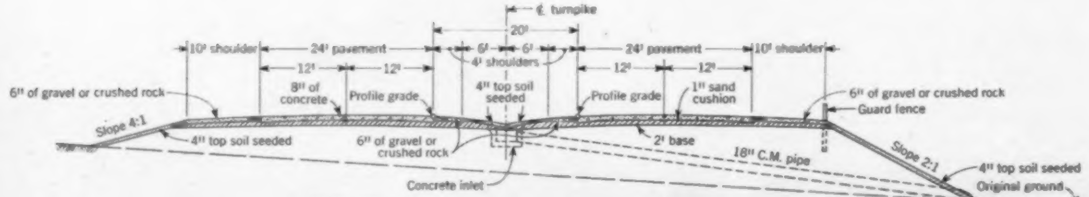
The turnpike, 17.3 miles long, is a four-lane, divided freeway with no cross traffic and entrance denied abutting property. Access is only possible at Federal Boulevard, at the Broomfield traffic interchange, and at Boulder. The fifteen county or state roads intersected by the turnpike are carried either over or under by separation structures. In addition to these structures, the Colorado & Southern Railroad is crossed by an overhead structure. Twin bridges are required at South Boulder Creek, Coal Creek, and Dry Creek, as well as at several irrigation canals.

The turnpike is composed of two 12-ft lanes in each direction separated by a depressed 20-ft median strip; shoulders 10 ft wide lie outside the travel lanes (Fig. 2). The right-of-way varies from a minimum of 200 ft to a maximum of about double that amount for deep cuts and high fills.

A complete set of soil samples was taken along the project. All soil of questionable supporting value was removed before grading and placed along the edges of the right-of-way. This material was later used on slopes that were to be seeded. Good base material was found in large quantities along the first section of the turnpike.

Denver-Boulder Turnpike . . .





A minimum of 2 ft of select material was spread in layers, wetted, and rolled with tamping rollers to prepare the base. On this base a 1-in. sand cushion was placed, and a slab of 3,500-lb concrete, 8 in. thick throughout, was poured for the wearing surface.

Contraction joints were placed at intervals of every 20 ft but expansion joints were only placed at the end of a day's run and at structures. Dual mixers were used by the paving contractor, in pouring the two 12-ft lanes at the same time. A white spray compound was used for curing, following the Hunt process. Three feet of the inside shoulder is finished with a bituminous surface. The outside shoulders are 10 ft wide, and the 3-ft width adjacent to the slab is finished with a bituminous surface.

Structures, in general, are supported on creosoted wood piles and abutments, and piers of concrete rest on pile clusters. Bridge superstructures are steel with concrete floors and metal railings.

One unique feature of the project is the single toll station located under the cloverleaf interchange at Broomfield (Fig. 3). Traffic can get on the project at either end or at this interchange. Detector plates placed under the three approach lanes on each side of the toll station register the origin and destination of each vehicle on an illuminated sign just ahead of the vehicle and in view of the toll collector. Through traffic from either Boulder or Denver to the other end of the project uses the inside lanes and pays full toll. The outside lanes carry traffic that is either getting on or off at Broomfield and the detector plates inform the collector as well as the driver of his origin and destination. When the collected toll is recorded in the cash register, the amount paid flashes on the illuminated sign. Both driver and toll collector are assured that the transaction is duly recorded, and it is believed that this system will encourage honesty on the part of both.

The depressed median strip will largely prevent traffic turning from one lane to go back on the other lane and thus avoid payment of toll. If it should develop that traffic tends to behave in this manner, it may be necessary to place a fence or closely spaced posts along the bottom of the depressed median strip. The speed limit for the turnpike has been established at 65 miles an hour. Toll for cars is 25 cents from Denver to Boulder, 10 cents from Denver to Broomfield, and 15 cents from Broomfield to Boulder. Two-axle trucks will pay 50 cents and each additional axle will cost 15 cents, to be spread in the same manner as the car fee.

The economic feasibility report of Howard, Needles, Tammen & Bergendoff estimated from the questionnaires and interviews that 60 percent of the total traffic between the two cities would use the turnpike. I am inclined to believe that this percentage is too low considering the saving in distance and time and the freedom from turning traffic. My

FIG. 2. Typical cross sections show design of roadway, with its two 12-ft lanes in each direction and depressed 20-ft-wide median strip.

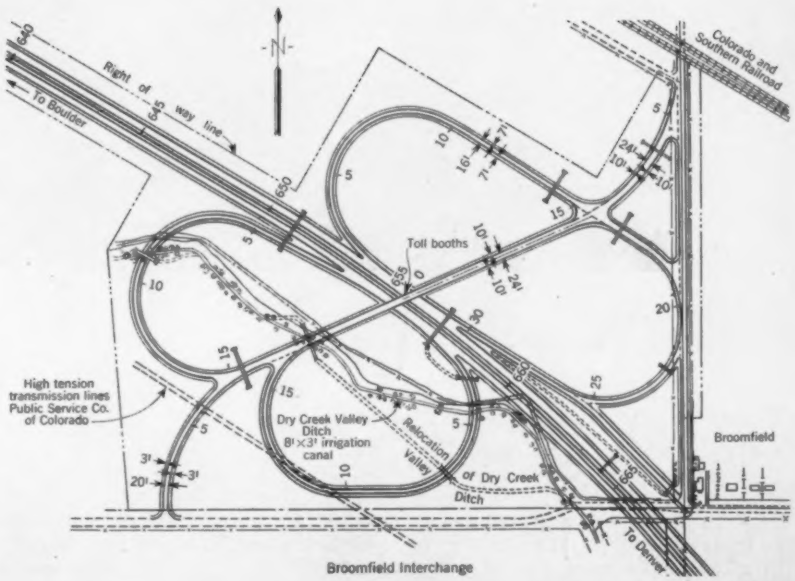


FIG. 3. One of turnpike's unique features is its single toll station, located at Broomfield interchange, here shown, near center of route. Booths are so placed that lane position of each car indicates its origin and destination, which are registered automatically on an illuminated sign. Traffic can enter or leave turnpike only at this interchange and at either end.

belief has been borne out by records of traffic use to date (Table II). The motorist who understands vehicle operation costs will readily perceive that the toll charged is far less than the saving in operation costs. Also it is believed that since this is the only really modern highway facility in an area of several hundred miles, its novelty will entice a large number of vehicles. Drivers will want to satisfy their curiosity about the project. In fact, its capacity may be taxed by peak flows such as may occur before and after football games. The bottleneck will probably be at the toll station at Broomfield.

The impact of this modern transportation facility on the region in which it is located will be tremendous. Boulder's growth will be limited only by its ability to supply home sites and utilities. Denver will find its expanding industrial growth supplied with a more stable and adequate labor supply. Workers in Boulder will be many minutes nearer jobs in Denver than other workers who must live on the outskirts of Denver. Denver's peak traffic load, holidays and Sundays, will have another outlet available that leads in the direction of the mountains.

Toll roads are not the answer to our perplexing highway finance problem, but in many cases they are, or can be, the answer in particular cases since they provide a ready solution in high-traffic areas. The motoring public readily appreciates the obvious advantages of the toll road and is willing to pay for the service rendered. The extension of toll facilities will soon set aside the oft-repeated axiom that "the earnings of high-traffic routes can logically be used for the improvement of less heavily traveled highways." Rather, what is badly needed is further education of the motoring public to drive home the fact that adequate highways are a necessity and not a luxury. A good road returns more benefits to its users than the amount required to finance it. If the Denver-Boulder Turnpike can do this the efforts that have gone into its planning, financing, and construction will have been entirely justified.

(Mr. Downing's paper was originally presented before the Highway Division session, presided over by Ben H. Petty, at the ASCE Denver Convention.)

TABLE II.

Traffic and Tolls on Denver-Boulder Turnpike Since Its Opening January 21, 1952

Period	Number of Vehicles	Tolls Collected
Jan. 21–Feb. 20	127,949	$28,541.37
Feb. 21–Mar. 20	110,680	24,193.30
Mar. 21–Apr. 20	124,371	27,255.30
Apr. 21–May 20	142,613	31,281.85
Four-month totals	505,613	$111,271.82
Per day	4,179	919.60
Cost per day, interest and operation		828.00
Profit per day		91.60
Profit per year		$33,400.00

Fifty years of reclamation progress

KENNETH MARKWELL, M. ASCE

Assistant Commissioner,

Bureau of Reclamation, Washington, D.C.

Address delivered at ASCE Denver Convention in symposium commemorating Semi-Centennial Anniversary of Bureau of Reclamation.

Today, June 17, 1952, we note the passage of an important milestone—the completion of a half-century of engineering enterprise in the conservation and use of the precious water supplies of the West. The growth and development of more than one-third of our country—virtually all of that portion lying west of the 100th meridian—is dependent on irrigation. Irrigation was recognized very early as the answer to the problem of the lack of rainfall in the West, and fifty years ago today the Reclamation Act became law, initiating an epoch of agricultural and economic growth unparalleled in the history of our nation. This is our Golden Jubilee as an organization.

Early History

Modern irrigation in the United States dates from 1847, when the Mormon pioneers, reaching the deserts of Utah in their wagons, realized that if they were to survive even the first winter they would have to raise a crop in spite of the desert. They thereupon diverted the waters of a small creek and irrigated a crop of potatoes. This project was bold in the circumstances, since its failure would have meant death to these pioneers. It well illustrates the kind of courage and imagination which are needed even today if the full potentialities of our great river basins are to be realized. We are fortunate today, however, in contrast to those first pioneers of irrigation, in having a great reservoir of technical knowledge to draw upon, from both government and private sources.

In the early days of irrigation it was comparatively easy for a single family with a team of horses and ordinary tools to lead water directly from a stream to the land. But later settlers found the streams already fringed with farms. To obtain water for the lands farther removed from the water courses, more expensive ditches and diversion works were necessary. To meet this situation small irrigation districts, organized on a community basis, were formed. Even today some 3,000 of these districts or ditch companies formed three or four generations ago remain in successful operation, as testimony to the fact that cooperation can move water as well as mountains. And sometimes even mountains needed to be moved to construct these early projects.

In time, further opportunities for local developments which could be constructed with the limited means available in small communities were exhausted. The people of the western states soon realized that if more of the land was to be brought under cultivation, assistance through legislation would be necessary. Thus by the end of the nineteenth century various enabling laws had been enacted making possible the formation of irrigation districts which had the power to condemn and to tax lands, and to operate as corporations. These methods of stimulating irrigation development again had a moderate degree of success.

By the turn of the century some 9,500,000 acres of irrigated land, representing an investment of a quarter of a billion dollars, testified to what the initiative and skill of private industry could accomplish under favorable circumstances. However, as more lands were placed under irrigation and the simpler projects were developed, once again a limit of expansion was reached. The increasing number of conflicting interests to be coordinated, the technical and financial problems of the more difficult developments, and the fact that the boundaries of drainage basins were not coincident with state lines, all indicated that if the program was to continue, help from the Federal Government would be necessary.

Reclamation Act Passed

The Reclamation Act of 1902, signed by President Theodore Roosevelt, was the Government's answer to the problem of conserving our Western water resources. Its effect was a grant of "life with a future" to the people of the western states. Without this Act, or something like it, it would not have been possible to provide for the greatly increasing population and expanding economy of the West. Largely through the wise provisions of the Reclamation Act, in the ensuing half century up to the present, irrigated lands have been developed to the extent that although they comprise less than 6 percent of the arable land, they provide the livelihood for 11 percent of the country's population.

During this relatively short period, the Bureau of Reclamation, operating in cooperation with the water laws of each state, has made irrigation water available to more than 6,000,000 arable acres. Power-hungry cities, industries, and farms are fed by

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RESEARCH

Baffle piers to dissipate high-velocity flow (far left), flow pattern in spillway chute of Tiber Dam (center), and flow through Alva B. Adams Tunnel are studied by models in Reclamation Engineering Center in Denver.

$4^{1}/_{2}$ million kilowatts of generating capacity in reclamation-constructed power plants. On more than 70 operating projects, tens of thousands of farm families have opportunity to exercise freedom of enterprise.

Returns from irrigation repayments and the sale of power to date have amounted to more than $300,000,000, and the annual rate of these returns is increasing as new land is irrigated and new power is put on the line. The value of crops grown on project lands last year alone was $650,000,000; cumulative crop values now amount to 7.8 billion dollars.

Reclamation water is the base on which entire communities have been built. Farm wealth from reclamation water—and industrial enterprise from reclamation power—create enormous markets for goods produced elsewhere in the nation. As an indication of the wealth produced by reclamation, irrigated project areas have paid an estimated 2.3 billion dollars in direct and indirect federal taxes—a sum greater than the $2^{1}/_{4}$-billion-dollar cost of construction to date.

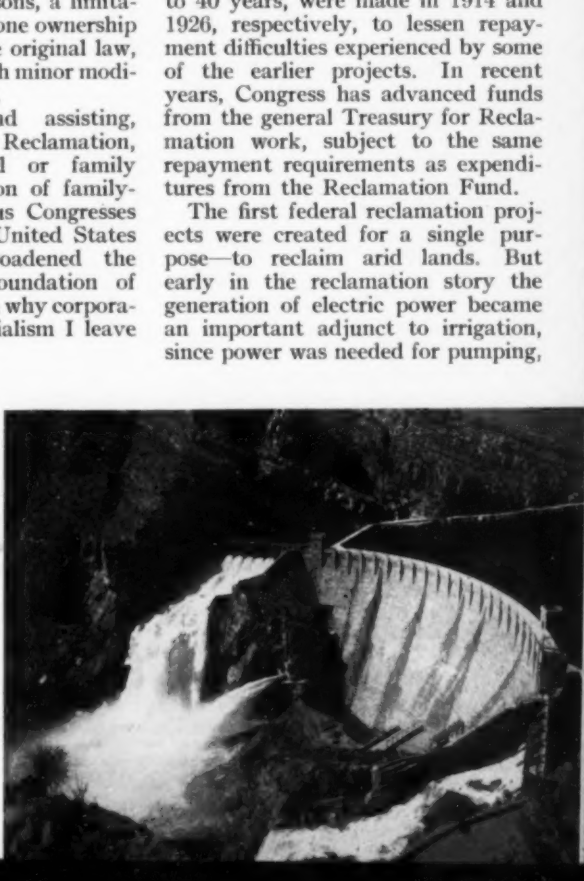
The Reclamation Act was designed to help the West to help itself. It established the Reclamation Fund, into which certain proceeds from the sale of public lands were to be deposited for investment in approved reclamation projects in the West. These projects were not to be gifts—largess from the public treasury. Costs of irrigation and power developments are repaid by the water and power users. The one concession—reflecting the national interest in the program—was that the irrigation costs were to be returned without interest. Three percent interest is charged against power developments, however. Subsequent legislation has enlarged the sources of increments to the fund and increased the period of repayment, but the principles of repayment and of reinvestment in further reclamation works have been retained. To insure a livelihood to as many families as possible and to prevent concentrating ownership in the hands of a few persons, a limitation of 160 acres under one ownership was incorporated in the original law, and this limitation—with minor modifications—stands today.

In encouraging and assisting, through the Bureau of Reclamation, independent individual or family ownership and operation of family-sized farms, the various Congresses and Presidents of the United States have, since 1902, broadened the basic free-enterprise foundation of our nation. The reason why corporation farms call this socialism I leave to your imagination.

As experience was gained, changes were made by the Congress—at the request of the people—extending the benefits of reclamation. The Warren Act of 1911 provided for sharing stored water with privately owned lands within the projects, and the Mineral Oil Leasing Act of 1920 added to the reclamation fund certain royalties derived from public-land oil leases. Extensions of the repayment period to 20 years, and then to 40 years, were made in 1914 and 1926, respectively, to lessen repayment difficulties experienced by some of the earlier projects. In recent years, Congress has advanced funds from the general Treasury for Reclamation work, subject to the same repayment requirements as expenditures from the Reclamation Fund.

The first federal reclamation projects were created for a single purpose—to reclaim arid lands. But early in the reclamation story the generation of electric power became an important adjunct to irrigation, since power was needed for pumping,

First major dam built by Bureau of Reclamation was Roosevelt, on Salt River, Arizona, completed in 1911. Salt River Project was one of first irrigation projects authorized under Reclamation Act of 1902.



and stored water provided an excellent souce of energy. In recognition of the opportunities afforded for power generation on reclamation projects, Congress decreed in 1906 that whenever a power development was necessary for the irrigation of lands under a reclamation project, or an opportunity was afforded for power generation, the Secretary of the Interior could lease for a period of not more than 10 years any surplus power or power privilege, giving preference to municipal purposes, so long as the lease would not impair the efficiency of the irrigation project.

Eventually, with the enactment of the Boulder Canyon Project Act in December 1928, the multiple-purpose project became recognized as a means of obtaining the greatest use of the limited water supplies of the West.

Water being so valuable, it was essential that our planning engineers learn to think in terms of the complete development of river basins, providing the well-rounded economy that spells out better living, seeking from the available water supply every service it can possibly perform. Thus we speak of the Missouri River Basin development, the Columbia River Basin, the Central Valley, the Colorado River Basin—all conforming to the principle of the full beneficial use and development of the river waters, and all offering hope and prosperity to the vast areas which long have suffered from drought or flood or both, or from electric power shortages.

In the Bureau of Reclamation we refer to this program as multiple-purposed. We mean by that, of course, the inclusion, within a single program, of all the elements based on water, that are needed for stabilizing the economy of a region. The point is well illustrated by the Central Valley project in California, which was conceived by the State of California, designed and constructed by the Bureau of Reclamation, and placed in integrated operation just last year after 15 years of intensive construction.

This spectacular project involves the transfer—by means of an extensive pumping and canal system—of surplus waters a maximum distance of 500 miles from the Sacramento River in the northern part of the state to the water-deficient San Joaquin Valley in the south. By the conservation and regulation of the water resources of the valley, about 1,000,000 acres of highly cultivated agricultural land are furnished a full or supplemental supply of water, some 450,000 kw of power are made available, navigation is improved, and salt water intrusion in the delta area near Sacramento is repelled.

An interesting example of the unique technical problems encountered in these river basin developments may be found in the highly complex but critically important studies made of the flow of water through the network of channels in the combined delta of the Sacramento and San Joaquin Rivers. All waters transferred from the Sacramento to the San Joaquin valleys must negotiate this maze of channels, affected by the tides of San Francisco Bay.

These studies were made on an electric analog computer, specially designed for the purpose. In this computer, hydraulic properties such as head and quantity of flow were represented by electrical properties such as voltage and current. A follow-up study was made on a network analyzer developed primarily for the study of transmission networks. This analyzer was more limited with regard to the number of factors included, but had the advantage that the factors could be varied in amount. A third purely mathematical analysis was also made. The results of all three studies were in agreement, and subsequent observations of actual flows in the delta channels have verified the results obtained, with a resulting saving of many millions of dollars.

Evolution of Reclamation Power

The production and sale of power as an integral function of projects has added greatly to the nation's power resources, and is a principal means of financing many water resource developments. With the advent of the multiple-purpose project, Congress in the Reclamation Project Act of 1939 expanded the basic power law of 1906 to better serve the people's needs. The act of 1939, in addition to making other needed reforms, recognized the potentialities of power as a revenue producer and as a means of helping irrigation to pay the costs of projects. It increased the maximum period of power leases from 10 to 40 years, and authorized rates that would recover not only the costs allocated to power but also an appropriate share of the construction costs allocated to irrigation, where such costs were in excess of the water users' ability to pay.

Continuing the policy laid down in the earlier acts, it was provided that preference in power sales be given to municipalities and other public agencies, and that no contract be made that would interfere with the efficiency of the project for irrigation. Power is sold at the lowest possible rates consistent with sound business principles. Disposal of power is such as to encourage widespread use and to prevent monopolization.

Benefits and Costs

On a typical reclamation project, costs are allocated to each of the purposes served. Power and irrigation costs, which usually comprise a major part of the total cost, are reimbursed by power sales and repayments from the water users. Other costs—including those allocated to such benefits as flood control, navigation, silt control, and conservation of fish and wildlife—are not reimbursable. They represent benefits accruing to the entire region or nation, hence properly are borne, by Congressional direction, by a broader portion of the population than would be represented in a local area.

The principle of allocating costs to each of the multiple purposes in accordance with the benefits received—whether in the form of actual cash returns or the more intangible benefits—is an entirely logical one. And it is wholly in harmony with the Government's policy of fostering and participating in the protection and conservation of our national resources.

Using the principles just outlined, and operating in strict accordance with state water laws and in cooperation with local interests, there have been brought into being such vast wealth-producing developments as the Central Valley Project mentioned earlier, and the Columbia Basin Project in Washington, bold examples of modern vision and ingenuity.

Columbia Basin Project works extend from Grand Coulee Dam on the Columbia River for a distance of about 125 miles to the south. The Grand Coulee Pumping Plant, with an ultimate capacity of 16,000 cfs, lifts a veritable river of water a vertical height of nearly 300 ft to irrigate eventually 1,000,000 acres of new project lands. A few weeks ago, water from three of the ultimate 12 pumps was made available to the first block of 66,000 acres of land. Grand Coulee Power Plant generates nearly 2,000,000 kw of power for the homes, farms, and expanding industries of the Northwest. It is operated as a base-load plant—a novel procedure in itself. The Columbia Basin Project is characterized by the superlative. Each of the three key features—the Grand Coulee Dam, the Power Plant, and the Pumping Plant—is the largest of its kind ever constructed.

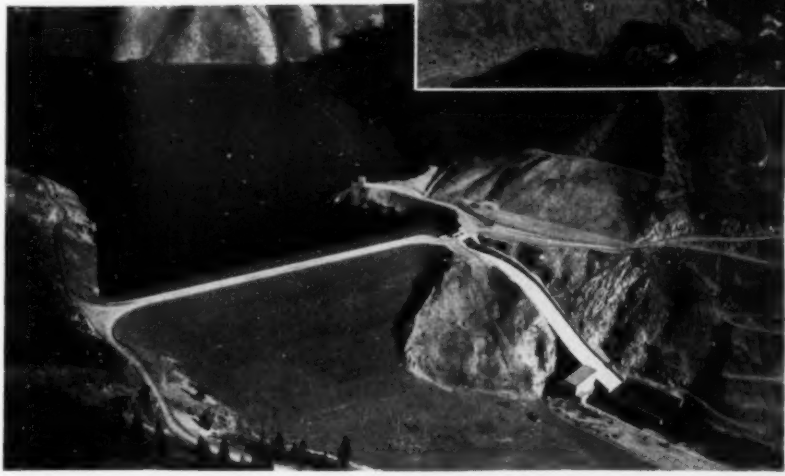
The Missouri River Basin Project in the northern half of the Great Plains region embraces one-sixth of the area of the United States. Precipitation in the eastern part of this area is greater than in most other parts of the West, but it is usually insufficient during the growing season and cannot be depended on for maturing most crops. The project was authorized by the Flood Control Act of 1944 and is being built jointly by the Bureau of Reclamation and the Army's Corps of Engineers. Under this development 12 Bureau dams have been constructed, three are under construction, and two others will be started this year. Work is also progressing on design and construction of extensive canal systems to convey the stored waters to the farm lands. Besides providing 2,376,000 kw of needed power and new and supplementary irrigation to some 6,465,000 acres of land, the project as a whole will provide a great measure of security against recurrence of disastrous floods such as that of April of this year.

Colorado's big transmountain diversion development, the Colorado-Big Thompson Project, north of Denver, was started in 1937 and is scheduled for completion of all major facilities by 1953. The project diverts surplus water from the headwaters of the Colorado River on the western slope of the Rocky Mountains, to the eastern slope to provide supplemental water for some 700,000 acres of land and to develop 177,650 kw of electrical energy. This is one of the world's most spectacular water resources projects. It is being dedicated today.

This project presents an impressive array of structures of many kinds. It has 15 dams, seven dikes, and 10 reservoirs totaling 984,975 acre-ft of capacity. Its 24 tunnels measure 35 miles in combined length, including the 13-mile-long Alva B. Adams Tunnel beneath the Continental Divide. Its water and power will be distributed by 93 miles of canals and 821 miles of transmission lines, including the units now functioning and those yet to be built. One of the unusual features of the project will be the Flatiron Power and Pumping Plant, now under construction. A 13,000 hp-unit in this plant, which will pump irrigation water from Flatiron Reservoir into Carter Lake, will do double duty as a reversible pump-turbine. When irrigation demand is slack, Carter Lake water will flow back through the unit and generate power to help meet peak loads on the system.

DAMS FOR IRRIGATION, POWER, FLOOD CONTROL

Ability to build large dams ranks in forefront of advances of past fifty years. Both world's highest concrete dam (Hoover, 726 ft, right) and world's highest earth-fill dam (Anderson Ranch, 456 ft, below) were built by Bureau of Reclamation.



Another interesting project is Hungry Horse Dam and Power Plant, on the South Fork of the Flathead River—a tributary of the Columbia—near Kalispell, Mont. It is now being constructed under the largest Bureau of Reclamation contract currently in force, and is scheduled for completion in 1954. The dam will be the third highest in the world and will store 3,500,000 acre-ft of water. The power plant will have a capacity of 285,000 kw. Hungry Horse Project is being built for hydroelectric power generation and flood control, and will greatly increase the firm power production and potential at all existing and proposed downstream power plants on the Columbia River system by improved river regulation.

Thus, through coordinated operation, the Hungry Horse plant will add, over and above its own capacity, 368,000 kw to the prime power supply of the Northwest, calculated on the basis of existing and presently authorized downstream plants. The benefit of Hungry Horse to recommended federal plants not yet authorized will amount to an additional 200,000 kw of prime power. The prospects for irrigation development in the Flathead Valley are also enhanced by the dam. A very substantial saving in construction costs is being realized through the use of fly ash, a combustion by-product of steam generating plants which burn pulverized coal. A major reduction in cement requirements, without impairing the strength of the concrete, is effected by replacing approximately one-third of the portland cement with the cheaper fly ash.

Until recently all construction activities of the Bureau of Reclamation were confined to the mainland of the United States. Last year construction began on the Eklutna Project in Alaska. The project will make available an annual output of 161,000,000 kw-hr of electrical energy to meet the critical shortage of power in the Anchorage and Palmer areas.

After a period of unsuccessful construction by contract during the early years of federal reclamation, the Bureau for several years built its projects by Government forces. But in 1925, the Department of the Interior adopted a policy whereby construction is performed under contracts awarded on the basis of competitive bids. Bureau engineers pre-

CANALS DELIVER WATER TO THE LAND

Canal lining procedures have been developed to assure construction economies and save thousands of acre-feet of water. All-American Canal is seen in two upper photos, Friant-Kern Canal in middle photo. In relatively short period of half a century, irrigation water has been made available to more than six million arable acres by Bureau of Reclamation. Development of irrigated lands has progressed until, although they comprise less than 6 percent of country's arable land, they provide livelihood for 11 percent of its population.

pare the designs and specifications and administer the contracts.

This procedure has proved eminently good business for the Government. Contractors have shown great skill and ingenuity in developing efficient methods and equipment for handling the varied construction problems found on reclamation projects.

Reclamation Engineering Center

The Reclamation Engineering Center here in Denver is what its name implies—a centralized assemblage of engineers, scientists, technicians, and laboratories mobilized for mass attack on the complex problems of Reclamation engineering. Here diversified, highly technical skills and talents are focused on the myriad problems which arise in connection with the great variety of structures, materials, and procedures involved in Reclamation engineering.

Designers here are concerned with the preparation of detailed plans and specifications for some of the world's largest and most complex engineering structures. Construction units deal with the great variety of contractual and administrative matters entailed in large-scale contract construction. Other groups are concerned with the geology of structure sites, the search for, and testing of, materials for construction, and with research toward the development of improved concepts, materials, and techniques. Still other groups are concerned with problems of hydrology and water supply, and with the most effective utilization of power produced on Reclamation projects. All are closely coordinated for a unified attack.

There is a large engineering library here where we assemble competent engineering knowledge from all over the world, and, if appropriate, adapt it to our use. We not only have some of the world's greatest technicians in their particular fields, but they have the skill and ability to apply the vast store of utilized special knowledge developed by many of the world's private and corporate consulting firms. Conversely, the Bureau makes its assembled knowledge available to the profession.

Foreign Activities

Reclamation technology accumulated over 50 years is now helping to promote human and economic welfare in the free countries of the world. The Bureau of Reclamation—its operating and supervising offices and its projects all over the West—has become an international mecca for other countries wanting technical aid

and inspiration in the adaptation of our methods of development of water resources projects to help feed and clothe their growing populations.

Under the program popularly known as Point IV, and other technical assistance programs, we are rendering diversified assistance to engineers in many foreign countries. These undertakings are carried out without interference with the domestic Reclamation program, and funds are made available by the foreign governments or through State Department or Mutual Security Administration sponsorship.

In the past five years nearly 1,000 foreign officials and engineers from foreign countries have observed Reclamation methods and consulted with Bureau engineers on a variety of engineering problems. In addition, nearly 500 engineering trainees representing 22 foreign countries have studied engineering and construction practices in the Denver offices and in the field. We are currently training 45 of these men, a number of whom have returned for a second course of study after having relayed much of their knowledge to others in their home lands.

Our engineers have gone to the far corners of the world—India, Pakistan, Australia, Thailand, South and Central America, Turkey and many other countries—to give technical aid in land and water resources programs. For example, a 21-man team of Bureau engineers and technicians is in Lebanon helping to investigate the possibilities of developing the water resources of the Litani River.

With the aid of foreign trainees, Bureau engineers and technicians at the Reclamation Engineering Center are performing stress studies, laboratory investigations, and other technical services in connection with proposed water resources facilities for the Snowy Mountains Hydroelectric Association in Australia, the Central Water and Power Commission in India, and Chao Phya Dam and power plant in Thailand, and other foreign projects. The technical work we do is not ordinarily suitable for consulting firms in private practice.

Our foreign activities program is definitely not a one-way proposition. Visitors and technical personnel from other countries make valuable contributions to Reclamation's fund of engineering knowledge. Indian engineers have contributed information on the problem of silting of irrigation systems. Norwegian engineers have contributed data on concrete dam construction, and Swiss engineers on snow surveys. Many European engineers have been particulatly interested in, and have contributed to our knowledge of, the high-voltage transmission of electricity.

The value of these exchanges cannot be measured in financial terms but in terms of mutual understanding and respect, and most important, in more food for undernourished thousands. They have contributed immeasurably to international peace. Technical information recognizes no international boundaries in the free world.

Trends and Possibilities

There is much reclamation work yet to be done, challenging our planning engineers. With some 25,000,000 acres of arable land under irrigation, the West is about at the halfway point in developing the irrigation resources available under present legislative standards. Only about 9,000,000 of the estimated potential 50,000,000 kw of hydroelectric power have yet been harnessed. And with the modern engineer—as with the early irrigator—the less difficult jobs have been done first. The extremely difficult diversions, storage works, and power developments lie ahead. But new concepts in planning, design, and construction are evolved as the need for them arises; new methods are devised for getting the greatest use of our limited water supplies.

The now-accepted concept of transbasin and transmountain diversions originated because nature endowed some drainage basins with large areas of irrigable land but insufficient water, while she gave others small amounts of irrigable land and water to spare.

New engineering developments are continually being made in this resource development program. As a result of intensive research in the technology of concrete and other materials, structures now being built are of increased economy and greater durability. Engineers have successfully modified orthodox canal lining procedures so as to assure construction economies and save thousands of acre-feet of precious water. Power transmission voltages have increased greatly since the first power plants were constructed, and transmission systems are now in operation at voltages as high as 287,500 v. Studies are being conducted on the use of superhigh voltages—possibly ranging as high as 400,000 v—for most efficient transmission of large quantities of energy over long distances.

The coming years will undoubtedly bring other new concepts with far-reaching effects. If investigations prove the feasibility—now highly controversial—of artifically inducing and controlling precipitation, it may be possible to control the depth of snowfall and thus insure more dependable water supplies.

Reclamation scientists are considering the possibility of converting salt water to fresh water on a large scale. Such conversion would probably be costly even under the best of conditions; but with water as with other commodities the concept of value changes with increasing scarcity. As supplies become more expensive, they tend to be used more efficiently on the better lands and on the more remunerative crops.

Bureau scientists are also studying the possibility of harnessing directly the tremendous energies of the sun and the wind for the generation of electric power. Other scientists are considering possible methods of developing power by the action of the ocean's tides. It is conceivable that in future decades our water and power supplies may be augmented from these sources.

Some of these future developments may well surpass in importance such major accomplishments of the past half century as the introduction of unprecedentedly high dams into the resource development picture, involving as it did the solution of countless technical problems not previously encountered. The accomplishment of the planning, design, and construction of these great structures ranks in the very forefront of the advances made in the past fifty years of Reclamation progress. A willingness to venture beyond all previous experience to develop designs and construction techniques for structures such as Hoover and Grand Coulee Dams was essential for the successful integrated development of entire river basins, since the basic requirement is the control over a river that these great dams provide. This complete control, and full utilization of the available water resource, could not be achieved by a series of smaller dams on the same rivers, however numerous.

This short history has outlined reclamation's progress during its first half-century. One can only speculate as to what the second half-century will bring. But with the continued support of the American people, the progress of reclamation through the coming decades will be limited only by the imagination, courage and engineering skill that are brought to bear on the nation's water resources development.

Engineers must be leaders in world of tomorrow

YOUR President's Annual Address is required by the bylaws. Because that address is placed in the Society's archives for posterity, it is frequently a most erudite and formidable document, setting forth the results of weeks of diligent research. But this is a most unusual year in our Society's history, one in which precedents must give way to obligation. For the engineer, this is the year of great decision.

The temptation will be strong, of course, to bask in the reflection of the glory that will be ours at the great Centennial convocation in Chicago, next September; to complacently accept the plaudits that will come with public recognition of the compelling part the engineer has played in the past hundred years of engineered progress.

A Great Opportunity

If that is the net result of our Centennial year and its celebrations, then the efforts and the money that have gone into it will have been wasted and we will have tragically missed the greatest opportunity in the long history of our profession. But if we accept our Centennial as the year of the engineer's coming of age, the celebration of his maturity, when it is incumbent on him to take stock of his inheritance and of his equipment in order to face the engineering world of tomorrow, then this will be a proud year for us and for our country.

Looking at the opportunities and demands ahead of us we must sense that we stand on the threshold of an engineering age, where mechanization and technological advancements dominate a materialistic world; where all life, thought and action are overshadowed by the fear of a third world war; where conflicting, confused ideologies and the indigestion of materialistic philosophies have undermined our spiritual life.

We look into the future to see two worlds—one dimly lit and but vaguely defined leading to a prosperous, happy world at peace, utilizing the products of engineered science for the universal benefit of mankind; and the other brightly lit and gayly festooned, readily defined by its signboards advertising an easy dissipation and by its mileposts of progressive degeneration, leading to a world in chaos.

To plot the course of the road to peace and prosperity and to expose to public view the mirage of the tinsel-fringed road to chaos, we will require a much improved transit, designed for employment by dedicated professional hands, to replace our outworn theodolite of short vision and subprofessional range.

No longer can we remain indifferent to the social impacts, the economic implementations and the cultural repercussions of our work and our inventions. No longer can we bury our heads in the sands of our chosen branch of engineering technology to escape the accusing eye of those who look to us for guidance and accurate road directions.

No longer can we hide behind our slide-rule and expect to be able to maintain the stewardship of our God-given privilege to utilize and direct the forces of nature for the benefit of mankind.

And no longer can we shirk our responsibilities for direction of the educational training of the young men coming into our profession, to meet the pressing demand for the truly professional man equipped to carry through in his expanding responsibilities for public leadership.

The engineer of tomorrow faces a radically changed set of conditions in a drastically altered atmosphere. The classic fears of man, influencing all past progress of civilization, those fears of the ravages of nature—storm, famine, cold and flood—have been dispelled by modern science, technology and engineering.

But while disposing of those fears, engineered science has created the current atmosphere in which man dreads, more desperately than he has ever feared before, the consequences of the inventions of science, technology and engineering. So today our Western world is grasping at the straws of pagan, Godless ideologies in a panicked attempt at defense against its fears that engineering science has invented and discovered beyond its capacity to control its forces of destruction.

Because of our direct responsibilities for the growth of this atmosphere of dread, we must accept our obligations for its immediate correction; the more so since our public leaders, either honestly misled or irresponsibly seeking personal power, too frequently see the solution in the agencies and trappings of the super state.

No engineer in this audience is immune to the enervating conditions and constricted opportunities that such statism is sure to impose. I am convinced that this is as true for engineers in the employ of government, federal or local, as it is for those in the employ of public utilities, of industry, and of consulting engineers in private practice.

Each of us, in no matter what type of engineering endeavor he finds himself, faces a deterioration of his standing in the public's estimation unless he himself assumes the responsibility of guiding and influencing public leadership at every opportunity. This may be in group action, such as through the activities of this great society of ours. It may be in personal conversations with friends. It will frequently be in speeches before lay audiences or in appearances before legislative committees.

In whatever form it takes, our responsibility for public leadership and for the maintenance and growth of a genuine professional status for ourselves is the challenge that this Centennial year brings to each of us. It is my hope today that I can emphasize to you the compelling nature of this challenge, and present a few of the ways in which it can be met.

And let us remember that our responsibilities for public leadership and for the maintenance of a genuine professional status, have not been suddenly thrust upon us. We have seen the inevitability of expanding responsibilities for years and have done little if anything about it. So today we face a cumulative responsibility.

CARLTON S. PROCTOR,
PRESIDENT ASCE

Moran, Proctor, Mueser & Rutledge,
New York, N.Y.

In Annual Address before Denver Convention, President Proctor urges renewed efforts to add to prestige of profession

At the annual meeting of the Society in January 1939, there was held a symposium by representatives of the American Institute of Architects, the American Bar Association, the American Medical Association and the ASCE. This symposium grew out of three years of study by the ASCE Committee on Professional Objectives and was held for the purpose of determining how our sister professions had obtained their advanced degrees of professional status and what was necessary to obtain improved status for the engineer.

How Can Status Be Raised?

Notwithstanding the fact that the ASCE was the oldest of all the national professional organizations, we recognized that the advancement of our prestige as professional men had not kept pace with the other represented professions. So we set out to find out why.

And many of the answers were readily apparent. In each case the national professional society considered had demanded and obtained steadily increasing standards of education until its professional training was placed on a postgraduate level, and had steadily upgraded the requirements for its accrediting of schools for professional training.

I represented the ASCE and closed the symposium with a summarization of the experiences of the other professions as they applied to our situation. In my paper I referred to the editorial statement in the November 4, 1938, issue of the English technical publication, *Engineering*, that "for all that the engineer is necessary to the maintenance of modern civilization, he still lacks status by comparison with members of other professions and with the administrators who control the undertakings that he has made possible. Status is something that can be conferred but cannot be commanded."

In concluding my paper, I had this to say:

"If we are thoroughly honest with ourselves, we will admit that we are but tilting at windmills when we place the responsibility for our present lack of status on any but ourselves.

"With the training for architects, lawyers, and doctors requiring a basic undergraduate academic course in the humanities followed by a postgraduate professional training, are not the engineers obtaining but a glorified trade-school training instead of a real professional education?

"It requires plenty of determination and fortitude to challenge the institutions of professional education; to force the abolition of competition for students between engineering schools; and to impose a strict self-discipline on the profession. But the fruits of such efforts are the objectives we seek."

A glance at the status of engineering education today should convince us that engineers as a professional group have failed to exercise the leadership and direction so long needed. We have failed in still greater degree to accept our special responsibilities in public affairs. Today our profession and our country have reached a road block; we can no longer evade our responsibilities for active leadership in public affairs. In the past much of the impetus for such leadership by engineers derived from their obligations as good citizens. But today those obligations devolve upon us also because of the necessity of defending our professional life and abolishing the prevailing atmosphere of confusion, loss of respect for our political institutions and agnostic defeatism—for all of which our profession must accept its full share of responsibility.

Can We Defeat Communism?

The political exploitation of men's elemental fear of the destructive power of engineered science has created a widespread doubt as to the ability of our democratic processes to combat the threat of Communism. Our leaders in public life should have been exposing the obvious fact that so long as this great nation of ours maintains its cherished principles of individual dignity and liberty; its atmosphere of mutual confidence and respect inherent in our competitive enterprise system; and our reliance on divine guidance, we have nothing to fear from the empty, embittered, soul-destroying philosophy of a system, so torn by suspicion, dissension and dread of the concentration camp, that it can be maintained only by a ruthless police-state dictatorship.

Instead, our leaders have encouraged men to turn back the clock to a dependence on the super-state as the best defense against the straw man called Communism, completely concealing the fact that the totalitarian state towards which we are moving so fast is exactly what we have fought two terrible world wars to defeat and that in its end result the centralized paternal state must embrace all of the evils, the moral and financial bankruptcy, and the retrogression to paganism, which are embraced by its alleged enemy, Communism.

For wherein is the end-result different? Both statism and Communism require state control of enterprise, demand the cancellation of individual freedoms, and deny man's hope of immortality. They both discredit the value of creative effort and inventive intelligence, preach the doctrine that ideas and incentive can be socialized, and require acceptance of the unethical and the expedient. And they both deify mediocrity. If there is a difference it is that statism attempts to outbid Communism by offering state-subsidized indolence and abundance—something for nothing—in other words, increasing return for decreasing effort. Only statism preaches that a man is a sucker who works any harder than he has to, because the taxpayer should take care of him anyway.

The job of guiding men's minds back to the simple precepts so fundamental to the growth of this Republic is ours, since statism's clever play of group against group, class against class, and sectors of industry against competing sectors, has resulted in the gagging, through threat of reprisal, of most of our industrial leaders, who should now be in the vanguard of this struggle for the survival of democracy.

Leadership of Engineers Needed

It devolves upon us, in that position of respect and trust which we have

(Continued on page 88)

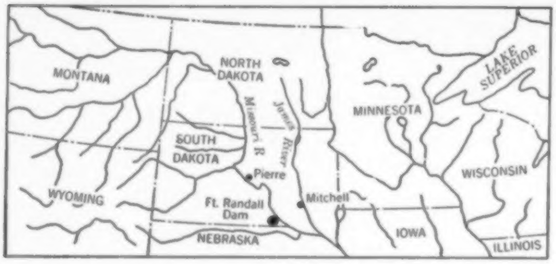
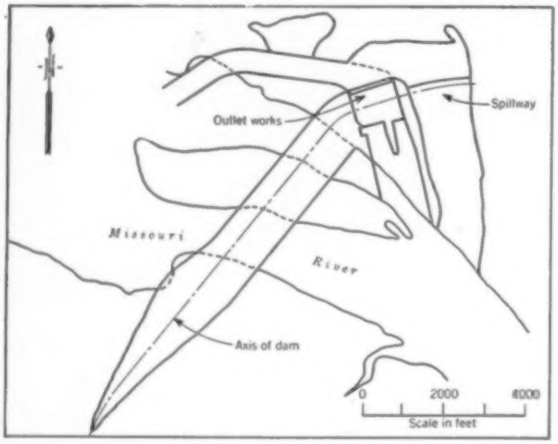


FIG. 1. Fort Randall Dam is located on Missouri River in southeastern South Dakota.



Fort Randall Dam

to provide mo

Fort Randall Dam, now under construction, will provide an important storage reservoir in the Pick-Sloan Comprehensive Plan for the conservation and utilization of water resources of the Missouri River Basin. It is located on the Missouri River in southeastern South Dakota about 55 miles southwest of Mitchell and 125 miles southeast of Pierre (Fig. 1). Together with the other large Missouri River dams located upstream, it will control the runoff of an area of 263,480 sq miles which constitutes over one-twelfth of the entire area of the United States.

The reservoir will have a capacity at maximum operating pool (El. 1,375) of approximately 6,300,000 acre-ft. At minimum flood control pool (El. 1,350) the reservoir will have an area of 81,700 acres and will extend upstream approximately 140 miles. In storage capacity it will be exceeded only by the completed reservoirs at Hoover, Grand Coulee, and Fort Peck Dams. The reservoirs at Garrison and Oahe Dams, which are both under construction upstream, will also exceed Fort Randall Reservoir in storage capacity.

All concrete structures will be placed on the Niobrara chalk underlying the site. It is composed of firm, argillaceous chalk and chalky shale derived chiefly from marine organisms and hardened flocculent lime ooze. The stratum, which is 145 ft thick and essentially horizontal, is homogeneous except for a few bentonitic clay seams scattered through the chalk layer with a large number of seams concentrated in the upper 20 ft of the formation. The chalk has an average in-place density of 122 lb per cu ft, 28 percent of which is moisture. Its average unconfined compressive strength is about 750 psi.

Embankment and Foundations

Practically all the materials used in constructing the embankment will be excavated from the outlet works and spillway sites. About 26 million cu yd of glacial drift overburden materials and about 19 million cu yd of chalk and shale bedrock will be excavated from these sources and placed in the embankment.

The central part of the dam is a rolled fill of glacial overburden materials. The more pervious overburden is being placed in the downstream third of this zone. The overburden is excavated with 11-cu yd electric shovels and transported to the fill in 30-cu yd carriers, which have been equipped with side boards so that they can transport a heaped load of 39 cu yd from the excavation to the embankment. The material is then spread in uniform 8-in. layers over the area under construction. Additional water is added if the moisture content is below that required for satisfactory compaction, which is obtained by six passes of a tamper-type roller.

An impervious blanket is provided to lengthen the seepage path under the dam. It extends 1,500 ft upstream from the toe of the rolled embankment and varies in thickness from 10 ft at the upstream end to 20 ft where it joins the rolled embankment section. This blanket is com-

Fort Randall Dam and Reservoir Project

Drainage area, sq miles	263,480	Excavation, cu yd	50,000,000
Reservoir storage, acre-ft	6,300,000	Rolled earth fill, cu yd	26,000,000
Maximumflowofrecord, cfs	343,000	Concrete, cu yd	900,000
Average flow, cfs	22,400	Power installation (40,000-kw units)	8
Spillway design flood discharge, cfs	620,000	Rated head, ft	112

more storage on Missouri River

HENRY J. HOEFFER, Colonel, Corps of Engineers; District Engineer, Omaha District, Corps of Engineers, Omaha, Nebr.

posed of glacial overburden material placed in 12-in. lifts. Compaction is obtained by not less than three passes of the spreading equipment.

The chalk and shale bedrock materials are being used to construct berms both upstream and downstream from the central rolled-fill section. Placement of a thick layer of waste chalk at flat beach slopes in the upstream berm eliminates the need for costly hard-rock riprap over most of the dam, resulting in a saving of about $3,000,000. This chalk fill has been designed for a 1 on 15 slope to withstand reservoir wave action.

With a large impervious dam section such as that designed for the valley fill, the seepage control is principally a problem of underseepage through the foundation. The alluvial foundation consists of interbedded layers of silty clays, sands, gravelly sands and clayey gravels. No evidence was found of any highly pervious gravel stratum in the alluvium. Seepage control for the valley section of the embankment is obtained principally by the long seepage path through the sand foundation created by the upstream impervious blanket. As an added assurance of adequate seepage control, pressure relief wells will be installed downstream from the toe of the rolled embankment.

The embankment section, shown in Fig. 2, is founded on top of the chalk formation and is composed of part natural glacial drift left in place and

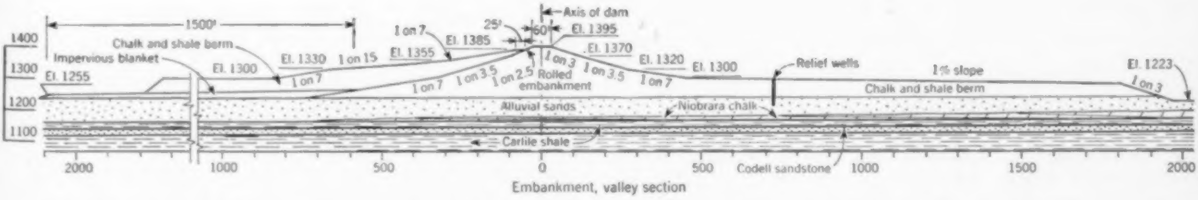


FIG. 2. Section through embankment and outlet works in valley section, left abutment, also shows foundation conditions.

Intake structure of Fort Randall Dam consists of 12 towers connected monolithically in pairs. Each tower is 180 ft high.

part rolled glacial materials. A layer of select impervious fill is placed on the upstream slope, varying in thickness from about 15 ft near the crest to 20 ft near the base. The layer is keyed into the top of the bedrock surface by a trench 20 ft wide and 5 ft deep. Boulders stockpiled from glacial overburden excavation are being used as riprap on the upstream slope of this section with a filter of spalls and sand-gravel as backing. A pervious toe drain and collector pipe will be placed at the toe of the embankment over the tunnels.

Several interesting problems in the design of this project developed in connection with the bentonitic clay seams scattered through the chalk layer. The lowest seam is about 1 in. thick and occurs near the springing line of the tunnels. These seams contain from 10 to about 30 percent clay mineral montomorillonite. Since these clays are much weaker in shear than the chalk, interesting design problems have been encountered concerning the stability of the dam over the tunnels, the spillway crest, and several large wall sections in the outlet works and spillway. The shearing strength of the bentonitic clay seams was evaluated from direct shear tests in the laboratory on 6-in. core samples and tests on 120-deg segments of 36-in. and 30-in. calyx cores. Another design problem developed in the areas of deep excavation in the downstream part of the outlet works and spillway stilling basin. High uplift pressures in the pervious Codell sandstone stratum about 20 ft below the bottom of the chalk formation were relieved during construction by pumping. A permanent system of relief wells is being constructed around the two areas to reduce the substratum pressures expected to develop from the reservoir head acting through the valley sands into the buried sandstone layer.

Outlet Works Used for Diversion

The outlet works (Fig. 3) will be used first for diversion of the river and then for releasing water from the reservoir for the generation of power or regulation of river flow. The outlet works will consist of an approach channel, intake structure, and 12 tunnels, 8 of which will conduct water to the turbines and 4 of which will provide an outlet discharge capacity of approximately 107,000 cfs with the pool at the spillway crest, El. 1,346. A combined tailrace and discharge channel will lead the flow back to the river channel. Of the 12 tunnels, 3 will have a finished diameter of 22 ft. The other 9 will have a finished diameter of 22 ft for 215 ft upstream and of 28 ft in the remaining 655 ft downstream.

The intake structure consists of twelve reinforced-concrete towers connected monolithically into pairs and bridged together at the top to form a continuous deck. Each tower is 180 ft high, 46 ft wide and varies in depth in the direction of flow from 110 ft at the base to 50 ft at the top. The total length of the top or gantry deck is 827 ft. Each of the 12 towers contains two 11 by 23-ft water passages, each provided with service-gate slots, emergency-gate slots, bulkhead slots, and a removable trashrack.

Each service gate will have an individually operated hoist located below the gantry deck. The four emergency gates, which are identical and interchangeable with the service gates, will permit emergency closure of two tunnels simultaneously. A spare hoist for operating the emergency gates will be stored in a space between towers. When needed, the hoist may be lifted and set in place on the gantry deck by means of the 125-ton electric traveling gantry crane. A 15-ton auxiliary hoist with an overhanging trolley travel projecting upstream from the gantry crane will be used to handle the bulkheads and trashracks. The 12 bulkheads, complete for two water passages in one tower, will be stored in spaces between towers. Mechanical and electrical equipment for operation of gates and for maintenance and repair of gates will be enclosed within the towers as protection from weather. In addition to the storage spaces mentioned, there are rooms for air compressors, a diesel electric standby unit, an office, and water treatment facilities.

Twelve tunnels in the left abutment will serve to pass water through the dam. The abutment at the tunnel site is composed of a 145-ft-thick layer of Niobrara chalk overlain by

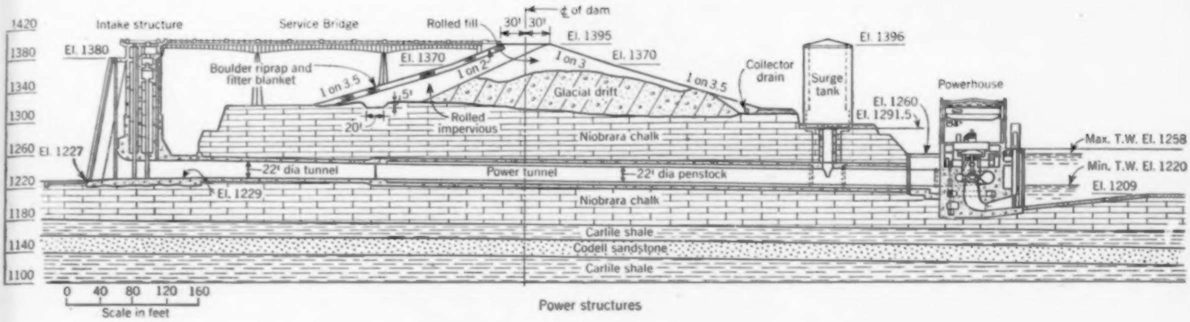


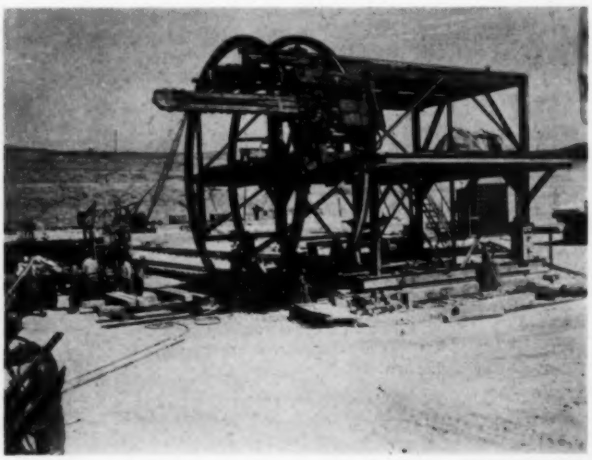
FIG. 3. Power structures consist of eight tunnels through substructures (one of which is shown here) diverting flow for eight Francis-type turbines each rated at 57,500 hp under 112-ft head. Generators will deliver 42,105 kva at 95 percent power factor.

glacial overburden. In some respects the chalk is an ideal material for a tunneling operation since it is easy to saw, drill, and blast. However, experience of the tunnel contractor has proven that it is also a treacherous material. Where intersecting slickensides and bentonitic seams occur, sizable blocks fall out with very little warning, making work under a freshly exposed face hazardous.

Prior to and during the time the tunnels are being designed, fairly extensive underground exploration was carried on. This exploration consisted of diamond drill holes, shot drill holes, and an exploratory drift. The exploratory drift was mined by Government forces to provide information on the tunneling characteristics of the chalk and to determine the stress conditions of the material. Information gained from the exploratory drift enabled engineers to set up criteria to be used for design of the bracing for the various tunnel sections.

The center lines of the tunnels are parallel and 70 ft apart. The stresses in the chalk formation caused by the closely spaced parallel tunnels were kept to a minimum by requiring that alternate tunnels be lined at least 100 ft ahead of drilling in the adjacent tunnels.

At tunnel heading (below left) overhead protection was provided against falling chalk. Jumbo-mounted coal saw (below right) was used to line-cut heading around perimeter. Method produced smooth surface well within excavation limits and minimized amount of grouting in concreting tunnel.



Spillway excavation, shown in background, will be located at east abutment of dam. Part of outlet works may be seen in foreground.

Line Drilling Tried and Abandoned

Cutting of the tunnel periphery before blasting was required as a precaution to preserve the mass of the chalk surrounding the tunnel. The contractor was allowed the option of line drilling or sawing. The first two tunnels were line-drilled. Even though the contractor line-drilled with a net thickness between holes not greater than the diameter of the holes, considerable overbreak was obtained. A jumbo-mounted coal saw was then devised by Silas Mason Co. to saw the circular periphery as required. With minor adjustments this saw served for the remainder of the tunneling. It provided a smooth chalk surface well within the excavation limits except where geological conditions were very unfavorable. The sawed periphery resulted in very complete filling by concrete operations as evidenced by the fact that very little grouting was required.

Full-face tunneling methods were used. The sequence of operations, after the job had settled down to routine, was as follows:

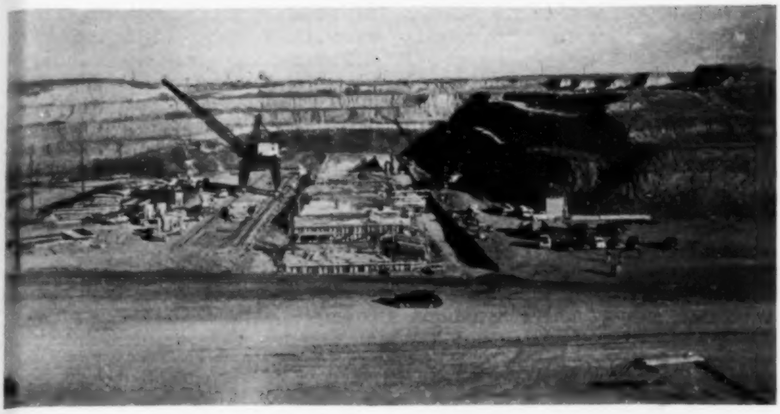
1. The saw jumbo was moved in and a full perimeter cut was made. Drillers working from platforms on the jumbo drilled holes in the working face and loaded the holes. The saw was moved to another heading.

2. The round was fired and the heading ventilated.

3. The mucker was moved in. The miners scaled the freshly exposed face to dislodge any hazardous-appearing chalk. The mucker loaded into Euclid trucks which were backed into the tunnel. A minimum amount of hand mucking was required. Access was available to the tunnel contractor only from the downstream end for both excavation and concreting.

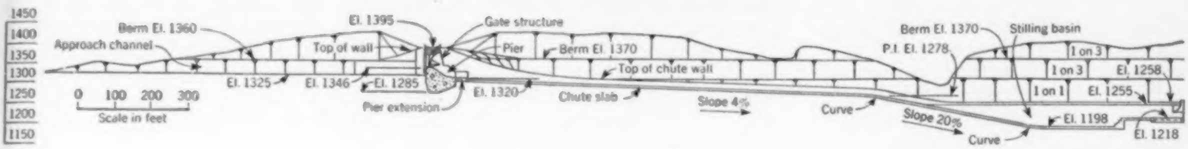
4. Another jumbo, which was truck mounted, moved into position

Concrete floor slab of stilling basin, 3 ft thick, is anchored to chalk by $1^1/_4$-in. bars. Slab is reinforced in two directions at mid-depth.



Spillway structure, shown under construction, contains twenty-one 40 x 29-ft radial tainter gates.

FIG. 4. Spillway, for which sectional elevation along center line is shown below, is located in left (east) abutment. Spillway structure consists of 21 bays, 40 ft long, through which discharge will be controlled by radial tainter gates individually operated by electrically driven hoists.



with the ring beam. The upper three sections of the beam were loosely bolted together and were suspended in a vertical position from the positioning platform of the jumbo. The angle spacers were used to locate the position of the new ring beam in relation to the last ring, and jacks mounted on the jumbo moved it out to the correct radial position. The connecting bolts were tightened and the invert segment of the beam inserted. The ring beam was then set to line and grade with hardwood blocks.

5. Rails for the saw jumbo and the mucker were extended and the operations repeated.

Each pass of the coal saw advanced the tunnel 8 ft. The ring beams were kept 9 ft behind the face. This sequence of operations left 8 ft of tunnel roof unsupported while miners were required to work beneath it. After several roof fall-outs had occurred, the contractor devised a rolling canopy cantilevered from the most forward ring beams out to the tunnel heading. This canopy was made from reinforcing bars and was sturdy enough to stop most fall-outs. Other fall-outs were retarded sufficiently to give warning to the men working below so that they could move out of danger. Several fall-outs occurred after installation of the canopy that might have resulted in serious accidents if it had not been used.

Pumpcrete was used to line the tunnels. Each monolith was 24 ft long and divided into invert and arch pours. The invert pour extends 30 deg to each side of the vertical center line. The curved surface was screeded, troweled, and treated by a vacuum process where specified. The arch forms were jumbo mounted and of the telescoping type. Doors in the sides of the forms provided access for workmen into the space between the form and the chalk face. When concreting reached the height of the top row of form doors, a pipe inserted through the bulkhead form at the crown was used to place the crown concrete. Cores taken later proved that this method provided good, dense concrete. However, the contractor proposed to place the crown of the arch pours by means of risers through the roof form. Several test monoliths were cast by pumping through the risers, and test cores drilled. When the concrete was found to be adequate and all overbreak voids were filled, the rest of the monoliths were placed by this method. The form jumbos were mounted on wheels which traversed rails supported on the invert pours.

Free-standing steel penstocks, 22 ft in diameter, will be installed in the tunnels with a finished concrete diameter of 28 ft. These penstocks will be supported by rockers and pedestals spaced at 24-ft centers. A contract for furnishing and installing the penstocks, together with the surge tanks, has been awarded.

When the reservoir is at maximum pool elevation, water from the flood control tunnels will have an initial velocity of from 80 to 90 fps. Two stilling pools have been provided to dissipate the energy. The upper or primary pool is a flared chute 500 ft long with side walls 48 ft high and a 25-ft-high ogee weir at the downstream end. Training piers about 140 ft long at the upstream end distribute the flow to the weir.

The slab for the primary pool floor is 3 ft thick with continuous reinforcement located at the mid-depth each way. The slab is cast directly on the chalk surface and anchored with deep $1^1/_4$-in. bars. Laboratory tests show that concrete cast on chalk has very low bond value. Therefore, to make the anchors effective, they were extended to the necessary depth to balance maximum uplift. A mechanical anchor was provided by expanding the bottom diameter of the hole to twice its drilled diameter, inserting an anchor bar with a plate welded to the bottom, and grouting the bar in place. Tensile strength of the chalk is very low because of the presence of joints, and was assumed to be zero in all uplift computations.

The secondary pool begins at the downstream edge of the ogee weir at the downstream end of the primary

pool and terminates with a 6-ft-high end sill 175 ft downstream. The floor slab is 19 ft below that of the primary pool. Side walls of the semigravity type are 50 ft high measuring from the basin floor.

A channel will be excavated to return the water to the river. Landward of this channel the chalk was cut to a 4:1 slope. A 5-ft-thick concrete slab was cast against the chalk and anchored back to it with $1^1/_4$-in. anchor bars spaced at 5-ft centers each way. This paved face varies in height from 50 ft at the upstream end to 28 ft at the downstream end in a distance of 495 ft.

Powerhouse Construction

The powerhouse is being constructed under two contracts. The first includes the substructure and tailrace and the second the superstructure, together with installation of the generating units and auxiliary equipment. This method of construction was selected so that the flow to be diverted through the eight power tunnels can pass through the powerhouse substructure during construction of the closure section of the embankment.

There will be eight main generating units with Francis-type turbines rated at 57,500 hp each under 112 ft of head with a speed of 85.7 rpm. The generators will deliver 42,105 kva at 95-percent power factor and 13,800 volts. The turbines and generators are now under contract with the Allis-Chalmers Manufacturing Co., and Westinghouse Electric & Mfg. Co., respectively. Two overhead cranes of 150-ton capacity each, under contract with Cyclops Iron Works, will be provided for installation and maintenance of the generating units. Four of the generating units will be equipped with high-speed governors, and their penstocks will be provided with surge tanks. The other four units are intended to operate on "blocked load" and will be equipped with slow-speed governors. To avoid the fabrication of extra-thick shell plates and to better distribute the foundation loading over the tunnels, eight surge tanks will be constructed, operating in pairs on each of the four regulating units. The surge tanks will be of the restricted-orifice type, 59 ft in diameter and 100 ft high.

Present plans call for four 115-kv and five 230-kv transmission lines ultimately to emanate from the switchyard, with provisions for one future unassigned line of each voltage. These lines will tie the power plant in with other plants to be built on the Missouri River and with publicly owned systems in the surrounding territory.

The spillway (Fig. 4) will be located in the left (east) abutment of the dam landward from the outlet works. Construction has been divided into two stages. Stage 1 will include construction of the approach channel walls and slabs, the gate structures, including the weir, piers, pier extensions, pier extension slabs, spillway bridge and tainter gates, abutment structures, and downstream abutment walls. Stage 2 will include the chute and stilling basin downstream from Stage 1.

The mass-concrete overflow weir will extend in a straight line between abutments and will be divided into 21 bays 40 ft long by twenty 8-ft piers for a net length of 840 ft. The upstream face of the weir will be vertical, and the top and downstream face will be in the form of an ogee curve with a crest elevation of 1,346 ft, or 21 ft above the approach channel floor. To control discharge over the weir there will be twenty-one 40 × 29-ft tainter gates individually operated by electrically-driven hoists placed near the top of the piers and abutments beneath the spillway bridge. The bridge will be a deck-type structure seated on the piers and abutments to accommodate the highway across the top of the dam. Each pier will contain access shafts and ladders leading from the hoist level to a trunnion access level. Each pier will be extended downstream from the weir for a distance of 30 ft to serve as a training wall. The footings of these pier extensions will provide the paved floor for a portion of the chute.

The east and west abutments will be reinforced concrete semi-gravity structures containing access stairways and ladders leading from the gate machinery level to a trunnion access level and to a gallery in the base of each structure. The west abutment will also include a control building containing space for control rooms, storage, and a standby generator for gate operation. The gallery will provide means to inspect the interior of the structure and to drain seepage collected by the pressure relief wells and the foundation drainage pipes.

The spillway chute will be 1,000 ft wide with a 4-percent slope for a distance of 1,020 ft and a 20-percent slope for a distance of 400 ft to the floor of the stilling basin at El. 1,198. The stilling basin will be 200 ft long and will be terminated at the downstream end by an end sill 30 ft long. The discharge channel will be flanked with walls for an additional 155 ft and paved for a distance of 75 ft.

The concrete is composed of crushed Sioux "quartzite" coarse aggregate, a specially processed glacial sand, Type II portland cement, and neutralized Vinsol resin air-entraining agent added at the mixer. The concrete was designed for a 28-day minimum compressive strength of 3,000 psi and a maximum water-cement ratio of 6 gal of water per sack of cement. The main bulk of the concrete contains 3-in. and $1^1/_2$-in. maximum-size aggregates, but 6-in. maximum-size aggregate will be used in the mass concrete of the spillway gate structure and the heavy walls. The cement content of the 6-in.-aggregate concrete varies from 3 to 4 sacks per cu yd, that of the 3-in. aggregate is 4 sacks, and that of the $1^1/_2$-in.-aggregate is five sacks per cu yd. The $1^1/_2$-in.-aggregate concrete placed in the tunnels, however, contains up to 6 sacks of cement per cu yd of concrete.

Air Content of Concrete

Air content of that part of the concrete containing only aggregate smaller than $1^1/_2$ in. is 3.0 to 6.0 percent of the volume of the concrete. To insure adequate durability, the air content of the concrete was maintained near the upper limits. To reduce the over-all temperature change, thereby reducing the tendency for cracks to form, the temperature of the concrete immediately after placement was not permitted to exceed 65 deg F in hot weather and 60 deg F in cold weather. The placing temperature was controlled by precooling the coarse aggregate, refrigerating the mixing water, and adding chipped ice.

Sources of coarse aggregate were selected after a comprehensive survey of deposits within an economical shipping radius of the site. The source finally approved was in the Sioux quartzite formation which outcrops in a number of places in southeastern South Dakota. This material is practically pure silica, very tough, with a high compressive strength and an excellent service record in concrete. However, it has a tendency to break into flat and elongated particles, and the producers at first felt that it would be impossible economically to approximate the cubical shape desired. However, by properly designing their plant, they were able to obtain the desired particle shape and the manufacturing cost was not excessive.

Fine aggregate was obtained from fluvio-glacial sand deposits in the

flood plain of the Big Soux River near Hawarden, Iowa. Similar deposits occur along the Big Sioux as far north as Watertown, S. Dak. One of the characteristics of this glacial sand is the lack of material in the finer fractions; consequently it was necessary not only to wash and classify the sand by conventional methods, but to run part of it through a rodmill to make up for the deficiency in fine material. The desired fineness modulus of the sand was about 2.5 and the grading was designed for use in concrete with low cement contents.

Construction Begun in 1946

Construction of access facilities to the dam site, housing and utilities for Government and contractors' employees, in the area which has become Pickstown, began in the summer of 1946. The town now has a population of 3,000. Work on the dam proper began in the fall of 1947 with a small earthwork contract to fill a chute of the Missouri River in the left bank as a base for later embankment construction. As of June 15, the rolled embankment on the left bank of the river is complete and the embankment on the right bank is under construction. All 12 tunnels have been holed through and lined. The intake structures, flood-control stilling basin, and powerhouse substructure are complete. River diversion and closure will be made during the summer and fall of 1952. Construction has continued vigorously since the start, and present planning contemplates first power generation late in 1953. The project will be ready to assume all its multiple-purpose functions in the spring of 1955.

Principal construction to date has been handled under ten major contracts. Western Contracting Corporation have succeeded themselves on three earthwork contracts, with L. Garland Everist as project manager. Silas Mason Co. has successfully completed the 12 power and flood control tunnels under the field management of R. B. Jewell, M. ASCE. The intake control structures, now complete, have been built by the Al Johnson Construction Co. and Winston Bros. Co., joint venturers, with Oscar McCormick as project manager. The same combine is constructing the spillway control structure under a contract for Spillway Stage 1. An eight-bay powerhouse substructure, tailrace, and flood-control stilling basin have been completed by McCarthy Improvement Co. under the field management of A. E. Foote. Work under the powerhouse contract has been started by Donovan-Lovering-Boyle, joint-venture contractors. Mason F. Travis is project manager. Contracts for construction of the steel penstocks and surge tanks, and the concrete-lined chute portion of the spillway structure have recently been awarded to Pittsburgh Des Moines Co. and a combine of Al Johnson Construction Co., Peter Kiewit and Sons' Co., Western Contracting Corp. and Condon-Cunningham Co., respectively.

Construction of the dam proper has been planned under 11 major contract components. This is partially due to the nine-year construction period and the difficulty of matching expenditures and annual fund appropriations. It is also desirable to complete the work as early as possible and this could only be done by starting construction as designs of structure components were completed, in accordance with a carefully planned design schedule. By keeping the contract size and construction time within reasonable limits, more accurate bidding has resulted during this period of economic uncertainty.

The described course of action required that a detailed construction planning program be conducted as an engineering function rather than as part of the usual responsibility of the contractor. Because of this program it has been feasible to fit the various contract components into a continuous logical construction program, with each contractor knowing his responsibility regarding timing of operations and minimizing interferences with the work of other contractors.

The Omaha District of the Corps of Engineers is directing construction. The writer is District Engineer. J. O. Ackerman, A.M. ASCE, heads the Engineering Division. The Construction Division is headed by Ralph R. Hawthorne. George O. Evans is Area Engineer in charge of Corps of Engineers operations at the job site.

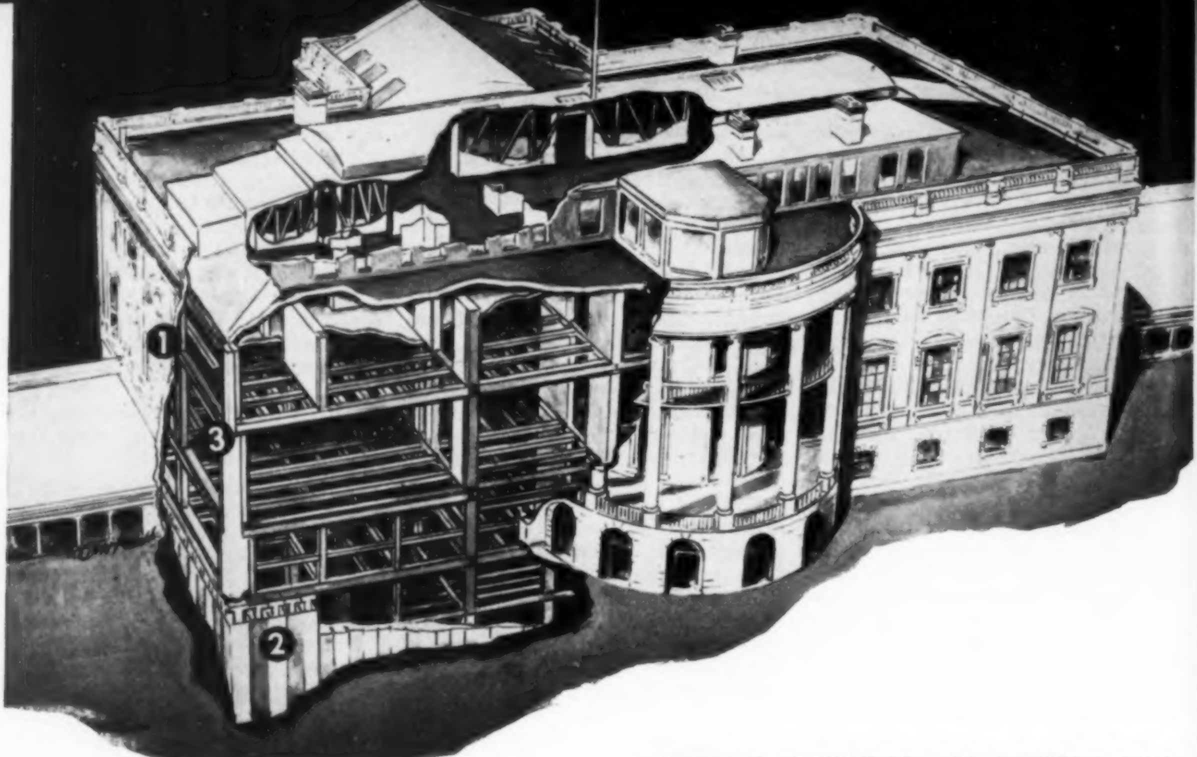
(This article is based on a paper presented by Colonel Hoeffer before a Waterways Division session presided over by Wendell E. Johnson, at the ASCE Denver Convention.)

How would you do it?

Some of the most fascinating chapters in the life and memory of an engineer are those which deal with the unusual and unexpected situations which almost got him down but from which he finally emerged the victor.—H. J. Gilkey

Even the best of our highway pavements are virtually unfumigated as regards the bugs (against most of which we continue to be more or less helpless). For example, research has shown that in hot weather the edges of a concrete highway slab are more subject to damage from a heavy wheel load in the night or early morning, whereas the mid-region of the slab (if there is no center joint or hinge), is more vulnerable from midday to evening. Why should this be true? For solution, see page 95.

Editor's Note: This is the fifth installment of a series which started in the February 1952 issue of Civil Engineering. In the April issue an article, "The Unexpected in Engineering: The Bugs," explains the project and enlarges upon the central theme that problems of the past created the practice of the present; that "The engineering of today rests upon a coral reef; sturdy remnants of yesterday's bugs." The process is a continuing one; there will always be today's and tomorrow's bugs to add zest and gray hairs to the practice of a profession that in its very nature must cantilever from a codified past to an untried future. "Long live bugs" is an ever-present challenge to the virility and ingenuity of the engineer. If you have a good bug, why not share it? H. J. G.



RICHARD E. DOUGHERTY, PAST-PRESIDENT ASCE,

The renovation of the Executive Mansion, popularly known as the "White House," has probably aroused greater interest throughout the country than any other construction project in recent years, especially with the President again in residence as of March 27, 1952. Under date of February 3, 1948, and as the newly inducted President of the American Society of Civil Engineers, I received a most startling letter, the essential portion of which read as follows:

> "It will be appreciated if you could find it possible to come to the White House at 10:00 a.m., February 25, 1948, for a meeting with Mr. Howell Crim, Chief Usher of the White House, and Mr. Lorenzo Winslow, Architect of the White House. We are also inviting Mr. Douglas W. Orr, President of the American Institute of Architects, and Mr. W. E. Reynolds, Commissioner of Public Buildings, Washington, D. C. The purpose of this meeting is to make a structural survey of the safety of the White House."

The letter was signed by Matthew J. Connelly, Secretary to the President. In company with Mr. Orr, I attended the meeting at the White House on February 25, 1948. We were met by Messrs. Crim, Reynolds and Winslow.

The President and others entrusted with the responsibility for the building had become alarmed at the increased effects of vibration in the second floor, manifested by the tinkling of the huge crystal chandeliers, the ominous creaking of timbers and other indications of possible structural defects. We carefully reviewed the few available plans of the building and made as complete an inspection as was possible with the essential structural portions of the building shrouded in plaster and building finish. It was perfectly obvious that the building, particularly the second floor where the family lived, was a fire trap, becoming structurally unsafe, and could not meet the requirements of any fire or building ordinances worthy of the name.

A report, then confidential, was immediately made to the President and signed by Messrs. Reynolds, Orr and myself, to the following effect:

I. FINDINGS AS TO STRUCTURAL ASPECTS

A. The second floor, generally, including the partitions, is of wood construction. The wood is in good condition, but obviously very dry.

B. The building has been remodeled from time to time by the installation of wiring and piping of various sizes by cutting sections or holes through supporting beams.

C. From the information submitted to the Committee, and from our preliminary inspection, it is our opinion that the timber construction is inadequate.

II. FINDINGS AS TO FIRE HAZARDS

A. The second floor, alone of all floors in the building, is of non-fire resistant construction, the wood has thoroughly dried, and is a definite fire hazard.

B. The building violates many of the principles of good fire engineering practice and presents a definite fire hazard to persons and property.

III. PREVIOUS FINDINGS

A. McKim, Mead and White, Architects, who remodeled the White House in 1902, pointed out the hazards connected with the second floor construction.

B. Delano and Aldrich, Architects, who were the consulting architects on the reconstruction of the third floor in 1927, strongly recommended the reconstruction of the second floor.

C. It is obvious that these conditions have existed for a great number of years and should not be permitted to continue.

RECOMMENDATIONS

A. The live load on the second floor should be restricted.

B. Extreme diligence should be exercised as to fire alarm and protection.

C. The situation should be carefully watched and further investigations conducted to determine the advisability of additional interim repairs.

D. The second floor should be reconstructed of fire-resistant construction at the earliest practicable date, together with appropriate changes throughout the building, to meet modern design standards.

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Cracked timber beams in second floor were found to be hung by rods from third-floor steel (right). These timbers were part of 1817 restoration.

LEFT

Cut-away perspective of White House shows structural-steel interior frame which supports all dead and live loads except exterior masonry walls, which were underpinned and supported on concrete walls extending to gravel stratum 24 ft below ground level. This drawing by Logan Reavis, showing South Portico elevation, is reproduced by courtesy of *Steelways* of American Institute of Steel Construction.

Wooden floor and walls of President's second-floor living quarters were structurally inadequate and a definite fire hazard.

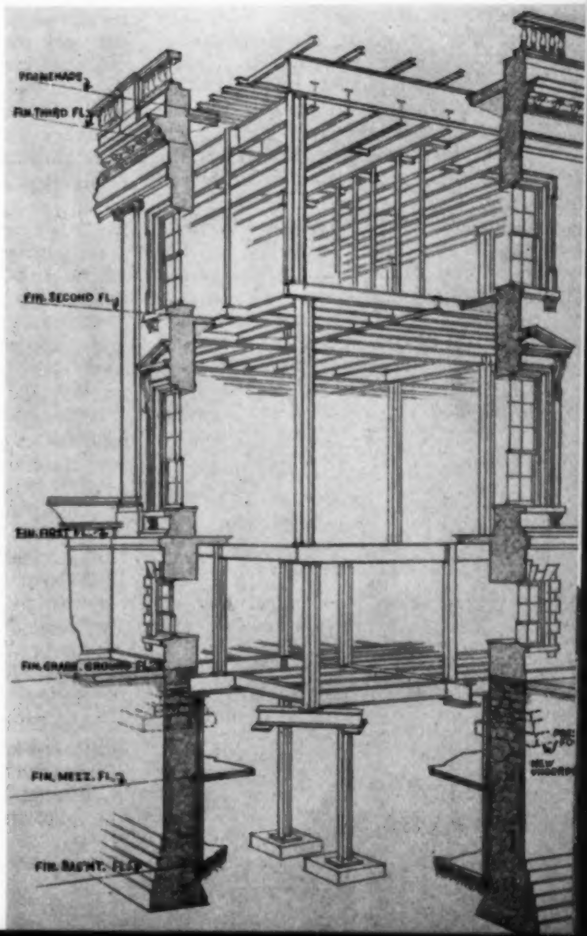
The White House made safe

Past-President EJC; Vice-President, Retired, New York Central System; Consulting Engineer, New York, N.Y.

Even then, and until a sufficient amount of plaster and building finish had been removed to permit adequate inspection, no one realized the extent of deterioration subsequently revealed. The only safe place on the second floor seemed to be the much discussed and maligned balcony. There were no proper fire exits for either the second or third floors. I inquired as to how, in the event of fire or other emergency, they had expected to get a crippled President out. The response was that a canvas chute had been constructed outside of his bedroom window on which he would be placed, in the event of trouble, by one of his husky bodyguards—then he would slide to the lawn where an automobile stood ready for service night and day during the war period. While undoubtedly not so conceived, nevertheless, the balcony did serve as sort of a psuedo-fire escape and would have given the President and his family a chance to get out of their rooms without having to jump from a window or be thrown into a chute.

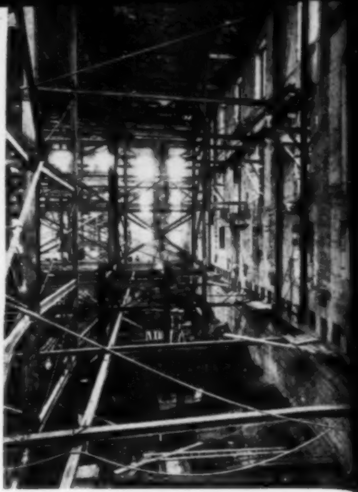
Mr. Orr and I were requested to come to Washington again on September 8, 1948. We again met with Messrs. Crim, Reynolds and Winslow together with C. L. Barber and C. K. Yingling, Jr., M. ASCE, structural engineers of the Public Building

In draftsman's perspective, southwest corner of White House is cut away to show underpinning, new basement floors, and new steel framework in place.



Construction view of northeast corner of White House shows underpinning of exterior walls.

After exterior walls were underpinned, temporary steel frame was placed inside building to support third floor and roof while crumbling interior brick walls were demolished and two-story basement excavated. Front-end loaders and small trucks excavated 10,000 cu yd for basement.

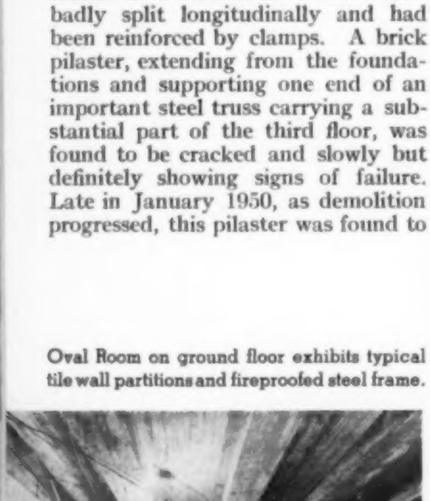


Column footings for permanent interior steel framework are seen in place in new basement excavation.

Service; Col. Douglas H. Gillette, Corps of Engineers; and Dr. Douglas E. Parsons, M. ASCE, Chief, Building Technology Division, National Bureau of Standards. Dr. Parsons reported then and subsequently as to various tests on the masonry. Among other things, we found that, in order to play safe and counteract some of the vibration, two 1-in. rods had been placed to suspend that part of the second floor carrying the President's office from the steel of the third floor and directly above the Blue Room with its heavy chandelier. Small rods had been placed at several other locations, suspending parts of the second floor from the third floor.

Two of the carrying timbers on the second floor were found to have been badly split longitudinally and had been reinforced by clamps. A brick pilaster, extending from the foundations and supporting one end of an important steel truss carrying a substantial part of the third floor, was found to be cracked and slowly but definitely showing signs of failure. Late in January 1950, as demolition progressed, this pilaster was found to have been cut for large ventilating and heating flues on the second floor level. Both timbers and masonry in various essential structural locations had been indiscriminately cut to provide for heating and ventilating flues, plumbing, water lines and other piping and electrical conduits. It is a wonderful thing to contemplate the abuses that materials of construction sometimes will undergo before failure. The interior walls, on inadequate foundations, primarily built of brick masonry laid with lime mortar, were seriously cracked in places by settlement. The exterior walls were generally about 4 ft thick with the outer course of Virginia sandstone and with a backing of stone or brick.

Oval Room on ground floor exhibits typical tile wall partitions and fireproofed steel frame.

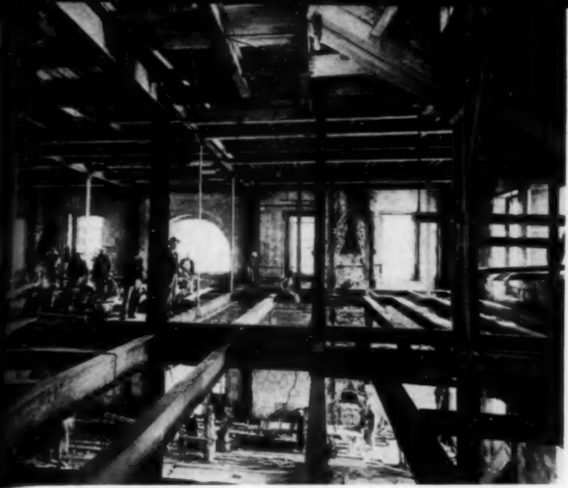


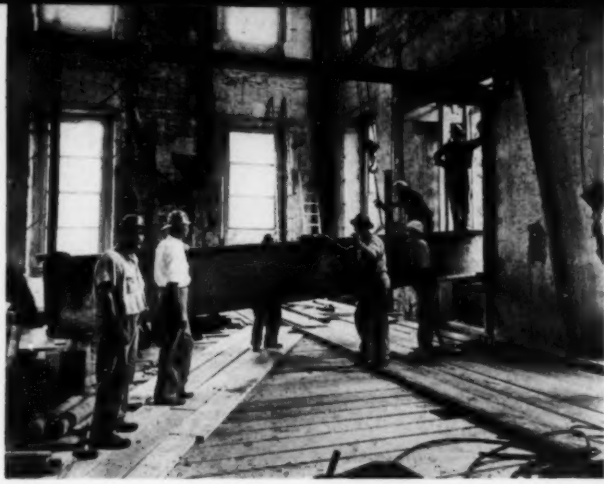
Mr. Orr and I concluded with Commissioner Reynolds that a major operation would be required and not merely a reconstruction of the second floor. In October 1948, when evidence was found of movement of plaster in the East Room, a detailed inspection revealed that a large section of the heavy ornamental plaster forming the ceiling of the East Room had dropped about 6 in. from the supporting timbers above. It was fortunate indeed that a large block of plaster had not fallen in the East Room on the occasion of some formal reception. The large and enormously heavy crystal chandeliers, three in the East Room and one in the Blue Room, constituted definite hazards. The President moved to Blair House in November 1949.

A History of the Building

The White House was originally projected and the cornerstone laid in 1792 with an elaborate ceremony conducted by the Freemasons of Georgetown. There was apparently a celebration after the ceremony at Mr. Sutter's Fountain Inn in Georgetown, where an elegant dinner was provided with sixteen different toasts. After the restoration of 1817, the walls were painted white, probably to offset discoloration and variation in the texture of the sandstone. Originally known as "The President's House" until the time of Abraham Lincoln, it was then officially called the "Executive Mansion" and so continued until Theodore Roosevelt issued an Executive Order establishing the name of the "White House."

The building was designed by James Hoban, an Irish architect, who won a competition which included Thomas Jefferson as an anonymous participant. Mr. Jefferson came out second. Hoban's conception supposedly followed the exterior of the Palace of the Duke of Leinster in Dublin, Ireland, now called Leinster House, and presently serves as the meeting place of both Houses of the Irish Parliament. The building was completed at a reported cost of $400,000, and was placed in service during the Administration of John Adams in 1800. After Thomas Jefferson became President in 1807 and assisted by Benjamin F. Latrobe, a most prominent architect of that day, he developed the designs of the North and South Porticoes and the East and West Terraces. The South Portico was added in 1824 under James Monroe and the North Portico in 1829 under Andrew Jackson. The building was burned by the British in 1814 and restored in 1817. The original timber construction was replaced, supported on the existing exterior walls. Other men in those days, faced with the decision as to whether or not to tear the building down and start anew,





Carpenters hang floor forms from permanent steel frame. This view was taken at second floor level, looking east from Monroe Room.

Workmen threaded permanent steel through windows and doors to final position in interior steel frame.

had decided against such procedure. Modern conveniences, then decidedly limited, were introduced from time to time without much regard for the cutting of timber and masonry.

The office functions of the White House are located in separate wings which are actually independent structures although connected with the main building. The President's office, the Cabinet Room and other general offices are located in the West Wing constructed in 1902. This wing, originally constructed under Theodore Roosevelt, was completely rebuilt in 1910 and the attic space converted to office space in 1927. The wing was substantially damaged by fire in 1929 and restored in 1930 and largely rebuilt in 1934. The East Wing, providing additional office space, small assembly and conference rooms, was constructed in 1942 under Franklin D. Roosevelt. These wings are of modern construction and there is no problem in that connection except that the office space available to the President on the White House grounds is neither adequate nor convenient for the purpose.

Since 1817, there have been two major alterations. The first was in 1902, during the administration of Theodore Roosevelt, when the first floor was rebuilt in an effort to restore something of the original architecture, and at the same time to introduce certain modern features and, among other things, to remove the office functions from the main building to the new West Wing. Changes were made in the ceremonial East Room, the State and Family Dining Rooms and, to a more limited extent, in the Blue, Green and Red Rooms, all of which, with the large hall and lobby, form the first floor. The second floor was left in its original structural condition with its timber framing, although the President's living quarters were somewhat modernized.

In 1927, during the administration of Calvin Coolidge, it was decided to improve the third floor construction and the roof structure was changed from timber to steel with a fire-resistant third floor, its weight being suspended from the roof trusses. The second floor was left unchanged. Thus, after 1927, the White House consisted of a first and third floor of fire-resistant construction and a second floor of timber dating back to the reconstruction after the fire of 1814. The reconstructions of 1902 and 1927 obviously changed the distribution of stress throughout the building. The recommendations of the engineers and architects of those days that the second floor be reconstructed and made fireproof were disregarded because of arbitrary executive limitations as to time and expense.

An initial appropriation of $50,000 for planning was authorized by Congress in 1948. Commissioner Reynolds, in conjunction with the White House Architect, L. S. Winslow, AIA, diligently proceeded to develop plans for reconstruction. At the request of the President, Mr. Orr and I collaborated with the Federal Works Administrator, Maj. Gen. Philip B. Fleming, M. ASCE, and Commissioner Reynolds, M. ASCE, in the presentation to Congress. Mr. Charles B. Spencer, President of Spencer, White & Prentis, all members of ASCE, who had been called into consultation, also appeared before the Appropriations Committee of the Senate. The 81st Congress, under Public Law 40, authorized an appropriation of $5,400,000 predicated upon the following:

"A. The underpinning of the foundations for the outer walls so that the building will rest upon a reliable stratum of sand and gravel at a level below the present wall footings.

"B. The removal of all interior walls. These walls have no spread foundations and rest upon inferior and compressible earthen materials.

"C. The construction of an independent interior structural steel frame to be supported by concrete piers that will be founded on the stratum of sand and gravel upon which the underpinning of the exterior walls will bear.

"D. Delivery to the independent interior structural steel frame substantially all of the weight of the structure and its contents except, principally, the weight of the exterior walls.

"E. The construction of an entirely new basement under the entire building within the outer walls provided therefore by the underpinning of the exterior walls.

"F. The replacement of the second floor by a new floor of fire-resistant construction.

"G. The replacement, including modest relocations and additions, of interior partitions and facilities upon the first and second floors; the remodeling and rearrangement, as may be appropriate, of the space and fa-

Floor laying in East Room on first floor approaches completion.

cilities upon the ground floor; and the development of space provided in the new basement.

"H. The construction of underground vaults for the accommodation of machinery and equipment for which there will be no appropriate available space within the remodeled building or which, for safety reasons, is better accommodated elsewhere.

"I. The installation throughout the building of modern heating, plumbing, electrical light and power and communications systems.

"J. The provision of complete air conditioning.

"K. The extension of the present elevator to the basement floor, the installation of a new service elevator to serve the lower floors, and a freight lift.

"L. The retention and perpetuation in the architectural development of the first and second floors of the basic proportions, space dispositions, finishes, details and motifs subject to such adjustment as shall be appropriate to accommodate modern materials and devices and to such minor corrections as shall prove proper to eliminate violations of the architectural orders.

"M. The elimination of fire hazards other than those otherwise removed by the reconstruction of the second floor.

"N. The exterior appearance of the building will not be changed.

"O. Installation of new floors upon the North and South Porticoes, granite steps leading to them, and replacement of concrete sidewalks in the formal garden by flagstones."

Commission Appointed

As recommended by the President, Public Law 40 of the 81st Congress authorized the work to be under the jurisdiction of a Commission to consist of:

(1) Two Senators appointed by the President of the Senate.

(2) Two Representatives appointed by the Speaker of the House of Representatives.

(3) Two persons appointed by the President of the United States from the executive branch or from private life.

Vice President Barkley for the Senate designated Senators Kenneth McKellar of Tennessee and Edward Martin of Pennsylvania. Speaker Rayburn for the House of Representatives designated Congressmen Louis C. Rabaut of Michigan and Frank B. Keefe of Wisconsin. The two representatives of the President were Mr. Orr and myself. Mr. Orr and I were designated by the Commission as a Technical Committee to study and screen technical and contractual questions, covering everything from the foundations to the building finish and interior decoration, and to take any necessary action between meetings. The Commission was organized in June 1949 with Senator McKellar as chairman and Mr. Orr as vice-chairman. Mr. Keefe retired from Congress at the end of 1951 because of a heart condition and died in February 1952. He was succeeded by Congressman J. Harry McGregor of Ohio.

To assist the Commission, Maj. Gen. Glen E. Edgerton (ret), M. ASCE, of the Corps of Engineers, was engaged as Executive Director, and Col. Douglas H. Gillette was assigned by the Corps of Engineers to assist him. Mr. Reynolds was designated to act as contracting officer and was requested to prepare the necessary plans and specifications in conjunction with General Edgerton and Mr. Winslow, the latter acting in his capacity as Architect of the White House. Mr. Winslow was designated as Secretary of the Commission. Mr. Reynolds was assisted by H. G. Hunter, M. ASCE, Deputy Commissioner; Allan S. Thorn, AIA, Supervising Architect of Public Building Service; C. L. Barber, structural engineer; and William H. Kelly, project engineer. Mr. Winslow was assisted by Harbin S. Chandler, AIA.

The Commission engaged as consulting engineers, Emil H. Praeger of New York and Ernest E. Howard of Kansas City, both members of ASCE, and as consulting architect, William Adams Delano, AIA, of New York.

Exterior Walls Retained

There was considerable discussion in Congress and elsewhere as to whether or not the building should be completely demolished and reproduced as closely as possible with walls of marble, limestone or granite, or possibly by the method of removing the stones forming the existing walls, laying them out on the White House lawn, carefully diagrammed and catalogued, and then replacing them in conjunction with an independent steel frame and fireproof construction to carry the interior walls and roof independently of the exterior walls. This last-mentioned method had been followed in connection with the restoration of many Egyptian temples and similar structures. Estimates showed that there would be a difference in cost of less than ten percent from the plan finally adopted as against the other methods above outlined. The decision to retain the old exterior walls met with general approval. It would have amounted to substantial desecration to have acted otherwise, particularly as it seemed to be quite unnecessary.

The structural and foundation problems and the question of whether or not the old exterior wall could be successfully underpinned, thus retaining the shell of the old building, constituted the most difficult and far-reaching question before the Commission in connection with the entire project and may be outlined as follows:

(a) Before the recent renovation, the White House was a four-story building consisting of ground floor, first floor, second floor and third floor. There was no basement except in one small area and the lower floor was at grade level. The construction was entirely "wall bearing." The exterior walls, generally of sandstone, were in reasonably good condition.

(b) There were two longitudinal interior walls, one at either side of the long central corridor, and transverse walls separating the rooms on the north and south sides of the building. These interior walls were of brick, generally about 3 ft thick in the upper floors and 4 ft thick in the lower floors.

(c) The construction of the floors was of various materials. The roof and third floor were of terra cotta blocks supported by steel beams; the second floor was of timber; and the first floor was of concrete slabs and steel beams. The pattern of framing was east to west and, therefore, the interior transverse walls carried a large percentage of the dead and live floor loads.

(d) All walls were supported on a clay soil about four feet below grade, but despite the heavy loading of the interior walls, there were generally no projecting footings under these walls as contrasted with generous spread footings under the exterior walls. As would be expected under this condition, the interior walls settled more than the exterior walls and large cracks developed at their junctions.

(e) A system of temporary steel shoring was carefully designed with two objectives: (1) to support the third floor and the roof and (2) to offer lateral support to the side-walls made necessary by the removal of the lateral support afforded by the old floors and walls.

(f) In the renovation, all interior walls and floors were demolished and only the exterior walls and the roof were retained. The steel erection was difficult inasmuch as the various columns and beams had to be threaded through windows and around the temporary shoring supporting the roof.

(g) In the renovated building a two-story basement was added to provide for increased mechanical and

electrical equipment, adequate public lavatory facilities (previously nonexistent), much needed storage space, etc. The structural necessity for underpinning the exterior walls to a level some 20 ft below the levels of the original foundations served not only the structural purpose but permitted a much needed two-story basement. The soil at this lower level consisted of sand and gravel, a more favorable material than the clay at the higher level of the old footings. Despite the removal of the heavy interior bearing walls, the weight of the structure as renovated is greater than that of the original building. This is accounted for by the added weight of the underpinning walls and the new basement floors.

(h) A number of borings were taken, two large test pits were dug to the new foundation levels and tests were made on the soil in the test pits. Laboratory studies of soil samples at the new foundation level indicated that the sand and gravel stratum could safely support a unit load of 4 tons per sq ft. Independent designs were made on two bases: (1) Unit loads of 4 tons per sq ft for total dead plus live loads; and (2) Unit loads of 3 tons per sq ft for total dead plus about 20 percent of total live load. The superstructural live loads are generally about 100 psf. The final design was based on the second premise which produces a more realistic foundation loading condition.

Despite the fact that the soil under the new basement is of greater load bearing value than that at the higher level, borings at the site disclosed a condition which called for a thorough foundation analysis. A layer of silt, about 6 to 7 ft thick, was encountered about 17 ft below the bottoms of the new foundations. Below this silt stratum, the soil is generally sand and gravel to rock with some silt intermingled usually in thin layers. The underpinnings and the new basement thus extended the footings into a satisfactory substratum of hardpan.

(i) The first constructional operation was that of underpinning the exterior walls, 4 ft thick, with concrete in sections approximately 4 ft long and 24 ft in depth. Previous laboratory study of undisturbed soil samples made in the Soils Laboratory of Columbia University by Prof. Donald M. Burmister, M. ASCE, in collaboration with Mr. Praeger indicated that the underpinning operation would, in all probability, cause exterior wall settlements of about one-third of an inch during the construction period. Further, these same laboratory considerations also disclosed that, with the next constructional operation of the demolition of the interior bearing walls, floors and partitions and excavation of soil in the new basement area, a rebound or upward movement of the soil under the walls would, in all probability, result, even predicting that this rebound would be about one-sixteenth of an inch. Results of precise leveling by the U. S. Coast and Geodetic Survey substantiated the laboratory predictions.

(j) The final operation was the erection of structural steel, concrete floors, partitions, installation of finished floors and plaster and seemed to justify that there might be some additional settlement.

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As the work progressed, and in certain instances, it became necessary for the Congress to give additional authority to the Commission to negotiate certain subcontracts in the interest of satisfactory progress. Congress eventually (in 1951) added $361,000 to the initial appropriation to cover increased costs incident to the Korean War. The work under the general contract was widely advertised by Public Building Service on behalf of the Commission, and contractors throughout the country were asked to advise whether or not they cared to bid with a submission of their qualifications. Fifteen potential general contractors eventually responded with bids ranging from $100,000 to $950,000 and averaging $341,000, with most of the bids between $200,000 and $350,000. The contractors' fee consisted of a lump sum of money, exclusive of any addition to total construction costs and including the following:

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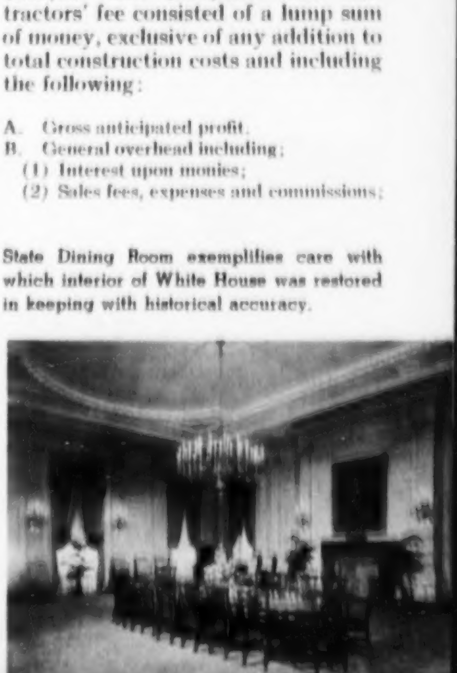

cilities upon the ground floor; and the development of space provided in the new basement.

"H. The construction of underground vaults for the accommodation of machinery and equipment for which there will be no appropriate available space within the remodeled building or which, for safety reasons, is better accommodated elsewhere.

"I. The installation throughout the building of modern heating, plumbing, electrical light and power and communications systems.

"J. The provision of complete air conditioning.

"K. The extension of the present elevator to the basement floor, the installation of a new service elevator to serve the lower floors, and a freight lift.

"L. The retention and perpetuation in the architectural development of the first and second floors of the basic proportions, space dispositions, finishes, details and motifs subject to such adjustment as shall be appropriate to accommodate modern materials and devices and to such minor corrections as shall prove proper to eliminate violations of the architectural orders.

"M. The elimination of fire hazards other than those otherwise removed by the reconstruction of the second floor.

"N. The exterior appearance of the building will not be changed.

"O. Installation of new floors upon the North and South Porticoes, granite steps leading to them, and replacement of concrete sidewalks in the formal garden by flagstones."

Commission Appointed

As recommended by the President, Public Law 40 of the 81st Congress authorized the work to be under the jurisdiction of a Commission to consist of:

(1) Two Senators appointed by the President of the Senate

(2) Two Representatives appointed by the Speaker of the House of Representatives

(3) Two persons appointed by the President of the United States from the executive branch or from private life.

Vice-President Barkley for the Senate designated Senators Kenneth McKellar of Tennessee and Edward Martin of Pennsylvania. Speaker Rayburn for the House of Representatives designated Congressmen Louis C. Rabaut of Michigan and Frank B. Keefe of Wisconsin. The two representatives of the President were Mr. Orr and myself. Mr. Orr and I were designated by the Commission as a Technical Committee to study and screen technical and contractual questions covering everything from the foundations to the building finish and interior decoration, and to take any necessary action between meetings. The Commission was organized in June 1949 with Senator McKellar as chairman and Mr. Orr as vice-chairman. Mr. Keefe retired from Congress at the end of 1951 because of a heart condition and died in February 1952. He was succeeded by Congressman J. Harry McGregor of Ohio.

To assist the Commission, Maj. Gen. Glen E. Edgerton (ret), M. ASCE, of the Corps of Engineers, was engaged as Executive Director, and Col. Douglas H. Gillette was assigned by the Corps of Engineers to assist him. Mr. Reynolds was designated to act as contracting officer and was requested to prepare the necessary plans and specifications in conjunction with General Edgerton and Mr. Winslow, the latter acting in his capacity as Architect of the White House. Mr. Winslow was designated as Secretary of the Commission. Mr. Reynolds was assisted by H. G. Hunter, M. ASCE, Deputy Commissioner; Allan S. Thorn, AIA, Supervising Architect of Public Building Service; C. L. Barber, structural engineer; and William H. Kelly, project engineer. Mr. Winslow was assisted by Harbin S. Chandler, AIA.

The Commission engaged as consulting engineers, Emil H. Praeger of New York and Ernest E. Howard of Kansas City, both members of ASCE, and as consulting architect, William Adams Delano, AIA, of New York.

Exterior Walls Retained

There was considerable discussion in Congress and elsewhere as to whether or not the building should be completely demolished and reproduced as closely as possible with walls of marble, limestone or granite, or possibly by the method of removing the stones forming the existing walls, laying them out on the White House lawn, carefully diagrammed and catalogued, and then replacing them in conjunction with an independent steel frame and fireproof construction to carry the interior walls and roof independently of the exterior walls. This last-mentioned method had been followed in connection with the restoration of many Egyptian temples and similar structures. Estimates showed that there would be a difference in cost of less than ten percent from the plan finally adopted as against the other methods above outlined. The decision to retain the old exterior walls met with general approval. It would have amounted to substantial desecration to have acted otherwise, particularly as it seemed to be quite unnecessary.

The structural and foundation problems and the question of whether or not the old exterior wall could be successfully underpinned, thus retaining the shell of the old building, constituted the most difficult and far-reaching question before the Commission in connection with the entire project and may be outlined as follows:

(a) Before the recent renovation, the White House was a four-story building consisting of ground floor, first floor, second floor and third floor. There was no basement except in one small area and the lower floor was at grade level. The construction was entirely "wall bearing." The exterior walls, generally of sandstone, were in reasonably good condition.

(b) There were two longitudinal interior walls, one at either side of the long central corridor, and transverse walls separating the rooms on the north and south sides of the building. These interior walls were of brick, generally about 3 ft thick in the upper floors and 4 ft thick in the lower floors.

(c) The construction of the floors was of various materials. The roof and third floor were of terra cotta blocks supported by steel beams; the second floor was of timber; and the first floor was of concrete slabs and steel beams. The pattern of framing was east to west and, therefore, the interior transverse walls carried a large percentage of the dead and live floor loads.

(d) All walls were supported on a clay soil about four feet below grade, but despite the heavy loading of the interior walls, there were generally no projecting footings under these walls as contrasted with generous spread footings under the exterior walls. As would be expected under this condition, the interior walls settled more than the exterior walls and large cracks developed at their junctions.

(e) A system of temporary steel shoring was carefully designed with two objectives: (1) to support the third floor and the roof and (2) to offer lateral support to the side-walls made necessary by the removal of the lateral support afforded by the old floors and walls.

(f) In the renovation, all interior walls and floors were demolished and only the exterior walls and the roof were retained. The steel erection was difficult inasmuch as the various columns and beams had to be threaded through windows and around the temporary shoring supporting the roof.

(g) In the renovated building a two-story basement was added to provide for increased mechanical and

electrical equipment, adequate public lavatory facilities (previously nonexistent), much needed storage space, etc. The structural necessity for underpinning the exterior walls to a level some 20 ft below the levels of the original foundations served not only the structural purpose but permitted a much needed two-story basement. The soil at this lower level consisted of sand and gravel, a more favorable material than the clay at the higher level of the old footings. Despite the removal of the heavy interior bearing walls, the weight of the structure as renovated is greater than that of the original building. This is accounted for by the added weight of the underpinning walls and the new basement floors.

(h) A number of borings were taken, two large test pits were dug to the new foundation levels and tests were made on the soil in the test pits. Laboratory studies of soil samples at the new foundation level indicated that the sand and gravel stratum could safely support a unit load of 4 tons per sq ft. Independent designs were made on two bases: (1) Unit loads of 4 tons per sq ft for total dead plus live loads; and (2) Unit loads of 3 tons per sq ft for total dead plus about 20 percent of total live load. The superstructural live loads are generally about 100 psf. The final design was based on the second premise which produces a more realistic foundation loading condition.

Despite the fact that the soil under the new basement is of greater load bearing value than that at the higher level, borings at the site disclosed a condition which called for a thorough foundation analysis. A layer of silt, about 6 to 7 ft thick, was encountered about 17 ft below the bottoms of the new foundations. Below this silt stratum, the soil is generally sand and gravel to rock with some silt intermingled usually in thin layers. The underpinnings and the new basement thus extended the footings into a satisfactory substratum of hardpan.

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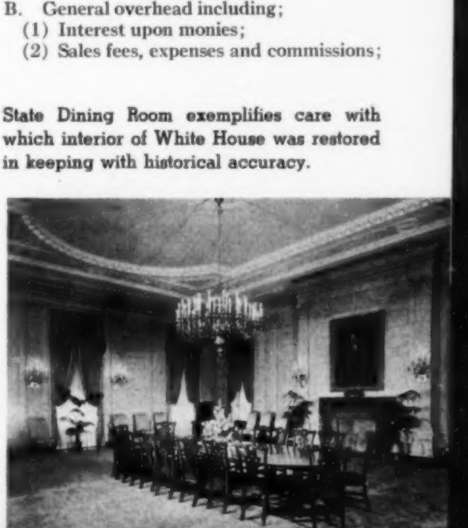


(3) Rent of central and branch offices.

(4) Salaries and wages (including insurance and taxes thereon), traveling expenses of central and branch office employees, Contractor's Manager and Chief Accountant, all such employees as engineering, clerical, surveyors, estimators, expeditors, office managers, accountants, purchasers, paymasters, timekeepers, material checkers, clerks, stenographers, typists, watchmen, waterboys and all other job overhead employees, excluding Superintendent, Assistant Superintendent and General Foremen.

(5) Regular central and branch office expenses.

(6) Bonuses, premiums and rewards to managers or superintendents or other employees, or contributions to charitable institutions.

(7) Taxes and similar charges.

C. Use of small tools and rope which will include all tools, devices and minor appliances classed as expendables.

D. Use of engineering instruments, office equipment and supplies, communication service, including telephones, telegrams, etc.

E. Use of construction equipment, whether for his own use or available to other contractors, excluding construction equipment furnished by subcontractors. This meant all costs except for electric current and labor of operators, and including the following:

(1) Rental.

(2) Depreciation, interest, taxes and insurance.

(3) Maintenance including labor therefor.

(4) Repairs including labor therefor.

(5) Fuel, grease, oil and consumable supplies required for operation.

(6) Shipping to and from the site and storage.

The low bidder was John McShain of Philadelphia with his bid of $100,000. In accordance with the provisions of the Law, the subcontract for the foundation work, together with the shoring, was negotiated with Spencer, White & Prentis on a cost-plus-a-fixed-fee basis. While there were many subsequent necessary variations in negotiating subcontracts as the work progressed, the contract for interior decorating and furniture, negotiated directly with John S. Burke, president of B. Altman & Co., was the only direct contract of importance other than that of the general contract with John McShain.

Each and every subdivision of the work was important to the satisfactory completion of the whole. It must be admitted that the interest of the public primarily centers in the architectural finish, interior decoration, furnishings and furniture. The more fundamental and difficult underpinning and structural problems, with the decision that the old walls could be retained, are forgotten. Engineers have become prone to recognize that their success is primarily registered by negative considerations such as the failures that do not occur, the estimates that are not exceeded, time schedules not extended and other fundamentals.

In the Act creating the Commission, Congress inserted the following stipulation:

"At the earliest possible date, the Commission shall recommend to the Congress and the President a plan for (1) the preservation of any of such material which is of permanent historical importance, and (2) the sale, donation, destruction, or other disposition of the remainder of such material in the manner most consistent with its symbolic value and without commercial exploitation."

There was much interest manifested in the disposition of the souvenir material. The Commission developed a souvenir program and filled about 30,000 orders for small pieces of old material, such as wood, nails, stone and plaster.

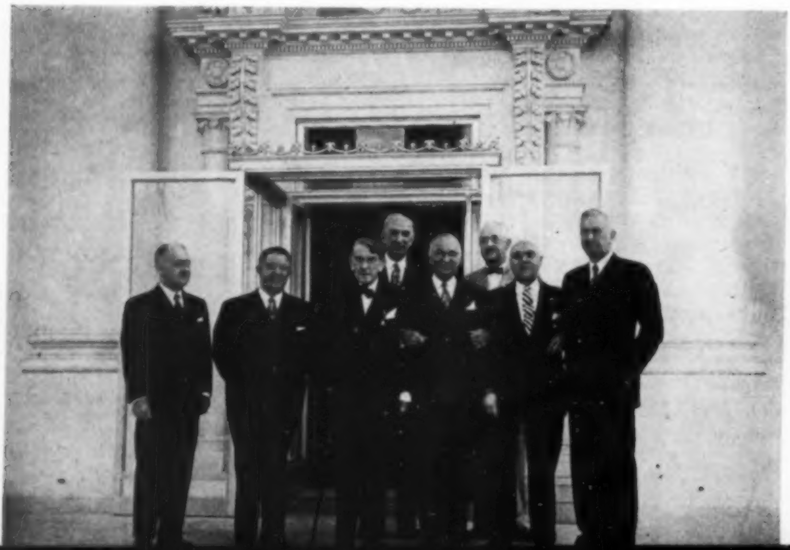
Space limitations upon this article do not permit description of the architectural finish, the complicated mechanical and electrical installations including air-conditioning, television and radio, broadcasting and communications which would be of great interest to engineers. The interior decorations and the furniture, the pianos and the pictures of the Presidents and the First Ladies have otherwise been much publicized.

The Commission is indebted to so many organizations and individuals for their help and cooperation that it is impracticable to mention them all or to select the most important. That purpose can best be served by quoting the inscription in letters of bronze on marble over the 42nd Street entrance to Grand Central Terminal, New York:

"TO ALL THOSE WHO WITH HEAD HEART AND HAND TOILED IN THE CONSTRUCTION OF THIS MONUMENT TO THE PUBLIC SERVICE, THIS IS INSCRIBED."

It was altogether a most interesting and fascinating experience, and an honor and a privilege to serve with Douglas Orr as representatives of the President. The Congressional members of the Commission were perfectly splendid. The Presidental family and staff were most courteous and considerate. Dr. John R. Steelman and Matthew J. Connelly, assistants to the President, and Howell G. Crim, Chief Usher, rendered valuable assistance throughout the project. The President gave much valuable advice and help and had an intense interest in the project, with a remarkably intimate knowledge of the White House, its history and requirements.

(*All photographs are by Abbie Rowe—Courtesy National Park Service.*)



Members of Commission on Restoration of the White House meet with President Truman and Maj. Gen. Glen E. Edgerton. Shown, left to right, are: Maj. Gen. Glen E. Edgerton, M. ASCE, Executive Director; Representative J. Harry McGregor of Ohio; Senator Kenneth McKellar of Tennessee, Chairman; Richard E. Dougherty, Past President of ASCE; President Truman; Douglas W. Orr, Past President of AIA, Vice Chairman; Representative Louis C. Rabaut of Michigan; and Senator Edward Martin of Pennsylvania; Representative Frank B. Keefe of Wisconsin was initially one of the six members of the Commission, but retired from Congress as of December 31, 1951, and Mr. McGregor was appointed to succeed him.

Why not use timber?

M. W. JACKSON, A.M. ASCE

Assistant Professor, University of Colorado, Boulder, Colo.

Eight arches of glued laminated wood with span of 60 ft and height of 45 ft form structural frame for Bethel Methodist Church in Chicago, Ill. Architect is Saltzman & Sons and contractor for trusses and arches, McKeown Bros. Co. of Chicago, Ill. Spans of 200 ft are not unusual for arches of this type and trussed arches have been built with spans up to 350 ft.

Photo by Calumet Industrial & Railroad Photograph Co.

In time of war, wood has been used for spectacular structures when competing materials have not been available. In times of peace, engineered timber structures have steadily competed with steel and concrete. No one material is the answer to all structural problems; each has its place. In time of emergency, however, the timber industry is more readily able to meet the crucial requirement for expansibility quickly and easily.

The production figures of the lumber mills are a clue to this ability to enlarge capacity. In the lumber industry, the largest western producer is Potlatch Forest, Inc., Lewiston, Idaho, an affiliate of Weyerhaeuser. The 1951 production of Potlatch was estimated at 265 million fbm and the 1950 production was 349 million fbm. This represents about one percent of the entire national production. The second and third major western mills in 1951 were Long-Bell Lumber Co., Longview, Wash., and C. D. Johnson Lumber Corp., Toledo, Ore., with outputs of 266 million and 171 million fbm respectively. It is apparent that the giant lumber producers accounted for only a tiny fraction of the output of the entire industry.

Two-thirds of the lumber output of the United States is distributed among 50,000 sawmills. The other third is produced by the 300 largest sawmills. Most of these mills have unused capacity, so that output can be increased substantially by merely increasing working hours without adding new facilities.

The Douglas fir plywood industry is an example of this flexibility of output. Production was near its capacity of 1 billion sq ft in 1939. In 1952 the capacity is 2.9 billion sq ft, meeting the estimated demand. Since this production is based on a normal 40-hour week, present capacity could be increased 20 to 25 percent if necessary by adopting a 48-hour week.

The wood industry is not content to be dependent on existing markets, but is alert to developing new markets through research. The plywood industry alone has installed fifty chippers in the past year to produce raw material for hardboards and paper pulp from otherwise waste material which was formerly burned, given away, or left on the ground to rot.

Hardboards made from wood fibers, hardboard-faced plywood, and plastic-surfaced plywood are recent developments tending to utilize forest products more efficiently as construction materials. In the chemical industry, the use of wood as a raw material is small, but is growing.

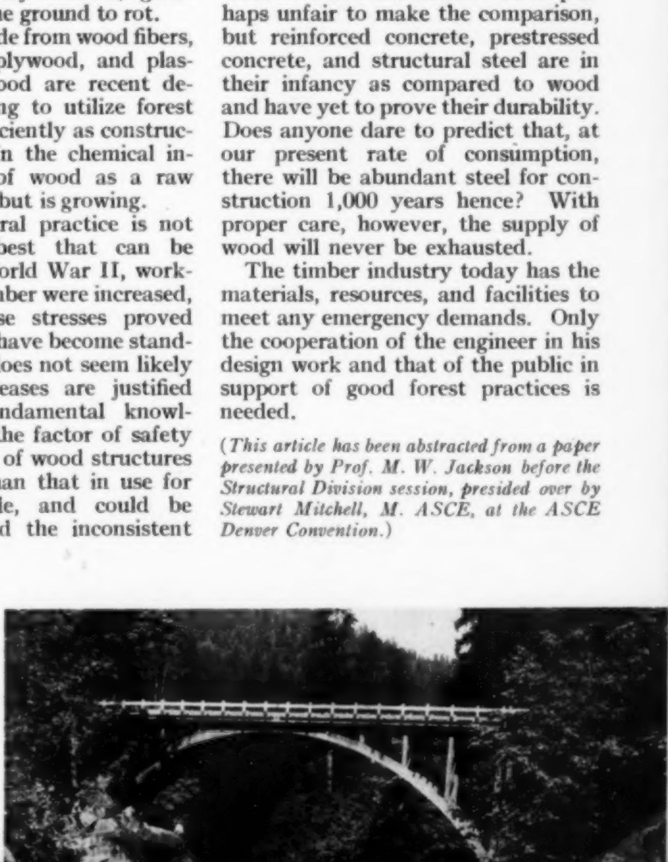
Present structural practice is not necessarily the best that can be developed. In World War II, working stresses for lumber were increased, and because these stresses proved satisfactory, they have become standard practice. It does not seem likely that further increases are justified without more fundamental knowledge. However, the factor of safety used in the design of wood structures is much higher than that in use for steel, for example, and could be reviewed, as could the inconsistent factors of safety used for the different methods of fastening timbers together.

Glued laminated construction, which has developed in the past thirty years, offers still further possibilities for wood. Solid arches of 200-ft span are not unusual for glued laminated wood, and trussed arches have been built with spans up to 350 ft. The use of glued laminated arches is not limited to protected locations. These arches have been used successfully for outdoor installations such as highway bridges.

Wood structures have stood the test of time. There are wood buildings 300 years old or more in better condition than buildings 30 years old built of other materials. It is perhaps unfair to make the comparison, but reinforced concrete, prestressed concrete, and structural steel are in their infancy as compared to wood and have yet to prove their durability. Does anyone dare to predict that, at our present rate of consumption, there will be abundant steel for construction 1,000 years hence? With proper care, however, the supply of wood will never be exhausted.

The timber industry today has the materials, resources, and facilities to meet any emergency demands. Only the cooperation of the engineer in his design work and that of the public in support of good forest practices is needed.

(*This article has been abstracted from a paper presented by Prof. M. W. Jackson before the Structural Division session, presided over by Stewart Mitchell, M. ASCE, at the ASCE Denver Convention.*)



Successful outdoor use of arches of glued laminated wood is demonstrated by 103-ft-span, Loon Lake Bridge, in Douglas County, Ore. This two-lane bridge is carried by four three-hinge arches.

ENGINEERS' NOTEBOOK

Sliding stability of retaining walls

GORDON P. FISHER, A.M. ASCE

Associate Professor of Civil Engineering, Cornell University, Ithaca, N.Y.

ROBERT M. MAINS, A.M. ASCE, Applied Physics Laboratory, Silver Spring, Md.

In connection with the teaching of a course in foundations, the writers became aware, particularly through discussion with practicing engineers, of variable and arbitrary practice in computing the passive resistance to sliding of retaining walls, and of a general lack of understanding of the basic action of wall and soil in developing such resistance. While none of the thoughts here presented are new, it is felt that a restatement may be helpful in clarifying this detail of retaining-wall design and in eliciting comment.

The problem arises chiefly in the computation of passive resistance against sliding of a wall under the active pressure produced by the backfill. This resistance to sliding is developed as friction between the base of the wall and the supporting soil, and as passive resistance of soil in front of the toe (and key, if any). With respect to base friction, there seems to be fairly general agreement as to its existence and computation, but on the other hand there are a number of curious procedures of questionable validity in current use for calculating the passive resistance acting on the frontal surfaces of the base. Two of the most commonly used ideas will be mentioned, both of which give values that are too high.

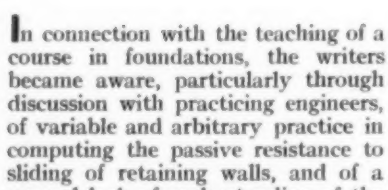


FIG. 1. Failure of soil in front of a wall will occur along arcs such as AB if there is no key, or FG if there is a key.

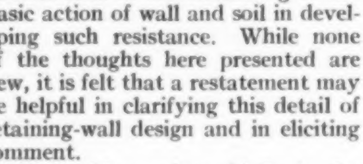


FIG. 2. Failure of soil by shear at ultimate bearing capacity of a footing takes place generally along arcs shown.

One method computes passive resistance to sliding as the product of the toe (and key) area and the allowable soil bearing value for the soil which supports the wall. The use of the soil bearing value in this instance is thought to be inadvisable for two reasons:

1. Passive resistance to sliding is concerned primarily with soil failure, whereas the allowable soil bearing, if intelligently prescribed, bears a definite relationship to settlement, in addition to accounting for soil failure.

2. Failure of the soil in front of the toe or key of a wall will occur along arcs such as AB for a wall with no key, or FG if there is a key, as shown in Fig. 1. Failure of soil by shear at the ultimate bearing capacity of a footing, on the other hand, takes place generally along arcs like those shown in Fig. 2. The two situations are in general different and incompatible, and further, the nature and specifically the length of the failure surfaces is radically different in the two cases.

Another common method of doubtful validity for computing passive resistance to sliding is to convert the base pressure at the face of the key to an equivalent height of soil, and then to compute the passive pressure at the level of the key for this equivalent height. Actually, this procedure gives passive pressures which are much higher than could be normally expected.

In reference to Fig. 1, it is the writers' contention that sliding failure will occur along the surface FGHJDE, with a simple separation along DJ, behind the key, and an inert block of soil BCHG pushed along in front of the key. The inert block and toe surface together push out a passive wedge of soil, FGK, and the resistance to failure of this wedge can only be based on a passive pressure computed for a height which in this instance is the sum of the key depth and the base-slab thickness (KB + BG).

This general mode of failure is concurred in by such soils engineers as Krynine (*Soil Mechanics*, McGraw-Hill, New York, N.Y.) and Terzaghi and Peck (*Soil Mechanics in Engineering Practice*, John Wiley & Son, New York, N.Y.). The assumed sliding surface may be subject to some minor variations in shape, but is fairly representative of failure conditions. Sliding stability may be checked, therefore, with the pertinent equation:

$$\Sigma H = F_{active} \text{ (times factor of safety) } - F_{passive} - \Sigma V \tan\phi$$

where the last term represents frictional resistance.

Three minor points may be noted:

1. The addition of a key to the wall does not appreciably increase sliding resistance, but does provide a convenient means of anchoring the stem steel of a cantilever wall or the counterfort steel of a counterfort wall.

2. The limit of dependable resisting soil has been shown in Fig. 1 as level with the top of the base slab rather than the full height of the toe fill in order to account for possibilities of erosion or removal of toe fill and of seasonal changes that would make passive resistance unreliable. Some designers prefer to neglect entirely the passive pressure in front of the base slab and depend on the key only for such resistance, but this is a minor matter for individual preference. If the toe fill has a paved surface, as for example for walls bounding a depressed urban highway, there is little danger of erosion and the full height of the toe fill is often taken as effective in providing passive resistance.

3. The choice for tan ϕ, the coefficient of friction between base and supporting soil, is a matter for some judgment. Terzaghi and Peck recommend tan ϕ = 0.55 for coarse-grained soils with little silt, and a

reduction to 0.45 for soils with higher silt content. They further recommend for clays and silts the placement of a 4-in. compacted base course of clean sand and the use of tan ϕ = 0.35 between the sand and the underlying soil. The value of ϕ for base sliding conceivably might be equal to the full value of ϕ defining the shearing resistance of the base soil, since the base slab is cast into a rough excavation with resulting sliding of soil on soil rather than of concrete on soil.

In conclusion, the safety factor in sliding should be mentioned. Current specifications governing the stability of retaining walls against sliding are, in general, variable and somewhat vague with regard to the safety factor to be used. The most explicit one is the Joint Committee Code, 1940, which provides that the sliding resistance shall be twice the computed active horizontal force. Other codes, such as AASHO and AREA, require only that the wall be "safe" against sliding or that the resisting force be "greater than the horizontal thrust," that is, a factor of safety a little greater than 1.

In practice, a safety factor of 2 is rather difficult to attain (except with some such doubtful procedure as outlined above) while at the same time maintaining an economical and well-proportioned wall, yet for important walls, where failure may precipitate loss of life or of adjacent property, it would seem that a safety factor larger than 1.1 or 1.2 is advisable. The writers feel that for the general case a safety factor of 1.5 is adequate and attainable, and are supported in this opinion by many soils investigators.

Analysis of anchor bolts and concrete piers for large stills and kettles

ANDREW A. BROWN, M. ASCE

Commander (CEC) USNR, Public Works Office, Fifth Naval District, Norfolk, Va.

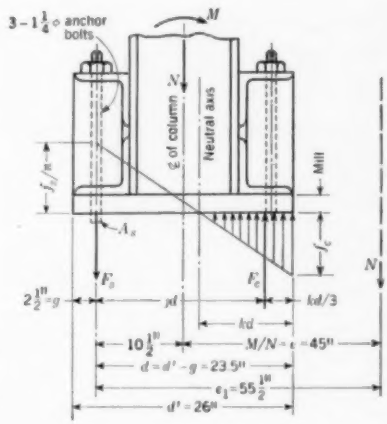


FIG. 1. Diagram illustrates problem of design of anchor bolts and gives numerical values for example.

In the design of anchor bolts and concrete piers for columns supporting vertical loads that are light in comparison to the moments introduced by wind, cranes or other eccentric loads, special care should be exercised to assure that the anchor bolts and the concrete supporting the base plate are not stressed beyond the permissible values.

The writer has noted that steel frames supporting large stills, kettles, tanks and other such equipment are often subject to larger horizontal forces in proportion to the vertical reactions than are usually encountered in other fields of design. This condition is further aggravated when the stills or tanks are empty, in which case the vertical forces are reduced but the area exposed to wind is not diminished.

The formula for unit stress,

$$f = \frac{P}{A} \pm \frac{M}{S}$$

has been used with considerable latitude for the design of concrete piers even though the results will only be correct when the resultant forces strike within the kern area of the base plate, in which case the anchor bolts will not be subjected to any force at all. When the resultant is outside the kern, this method does not err on the side of safety. Under this condition the concrete will be more highly stressed. In the solution here presented it is assumed that the horizontal forces transmitted from the base plates to the pier are brought about by the coefficient of friction or some other means besides the anchor bolts.

The problem can readily be solved by using tables or formulas developed for the analysis of concrete beams with some tension existing at the section. These formulas are based on the same assumptions that are made in the development of formulas for flexure and utilize the familiar symbols employed in the design and analysis of concrete beams. The symbols follow:

f_s = unit stress in steel (anchor bolts), in psi

A_s' = net area of anchor bolts or bolt on tension side of beam, in sq in.

f_c = maximum unit stress in concrete, in psi

E_c = modulus of elasticity of concrete, in psi

E_s = modulus of elasticity of steel, in psi

n = E_s/E_c

N = vertical load applied at center of column, in lb

M = bending moment at bottom of base plate, in lb-in.

e = M/N, eccentricity, in in.

g = edge distance of anchor bolts, in in.

d' = length of base plate

d = $(d' - g)$

b = width of base plate

F_s = total force on anchor bolts = f_sA_s', in lb

F_c = total force in concrete = $f_c \frac{1}{2} bkd$, in lb

kd = distance from edge of base plate to neutral axis

P = ratio of area of steel to concrete = A_s/bd (A_s = gross area of anchor bolts on tension side of the beam.)

It is noted that there will be three unknowns (f_c, f_s and k) so three inde-

pendent equations will be required to find them. Two are found by statics and the third by Hooke's Law.

By reference to Fig. 1, it is seen that by taking the summation of the forces in the Y direction, we get

$$1/2 f_c\, bkd = f_s A_s + N; \text{ and } A_s = pbd.$$

$$\text{Then } N = \frac{1}{2} f_c\, bkd - f_s\, pbd \quad . \quad . \ (1)$$

By taking moments about the center of the anchor bolts,

$$Ne_1 - \frac{1}{2} f_c\, kjbd^2 = 0$$

$$N = \frac{f_c\, kjbd^2}{2e_1} \quad . \quad . \quad . \quad . \ (2)$$

By Hooke's law,

$$\frac{f_s}{f_c} = \frac{n(1-k)}{k} \quad . \quad . \quad . \ (3)$$

Combining Eqs. 1 and 2 eliminates N and gives

$$\frac{d}{e_1} = \frac{k - 2p\,(f_s/f_c)}{kj} \quad . \quad . \ (4)$$

Substituting in Eq. 4 the value of f_s/f_c in Eq. 3 and $j = (1 - k/3)$

$$\frac{d}{e_1} = \frac{k - 2pn\left(\frac{1-k}{k}\right)}{k\left(1 - \frac{k}{3}\right)} \quad . \ (5)$$

By clearing of fractions, the final equation becomes

$$dk^3 + 3\,(e_1 - d)\,k^2 + 6e_1pnk = 6\,e_1pn \quad . \quad . \quad . \quad . \quad . \quad . \quad . \ (6)$$

Application Shown by Example

The application of this formula will be shown by an example.

Given: M = 1,350,000 in.-lb; N = 30,000 lb; n = 12; b = 17; d' = 26 in.; A'_s = 2.67 sq in.; and A_s = 3.68 sq in.

Other numerical values are shown in Fig. 1. Substituting in Eq. 6, we get

$$23.5k^3 + 3\,(32k^2) + 6\,(55.5 \times 0.1106k) = 6 \times 55.5 \times 0.1106$$

Dividing through by 23.5,

$$k^3 + 4.085k^2 + 1.567k = 1.567 = C \quad . \quad . \quad . \quad . \quad . \quad . \quad . \ (7)$$

Assume a value of 0.40 for k. Then

$$k^3 + 4.085k^2 + 0.1106\,k = 1.344 = C_1 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \ (8)$$

By taking the first derivative of Eq. 7,

$$(3k^2 + 8.17k + 1.567)\,dk = dC = C - C_1$$

Substitute k = 0.40. Then

$5.315\,dk = 1.567 - 1.344 = 0.223$; $dk = 0.04$, and the actual $k = 0.40 + 0.04 = 0.44$.

This method of solving the cubic equation gives values close enough for most problems. However, if greater accuracy is desired, the value of 0.44 for k can be substituted in Eq. 7 and the method gone through again.

This equation can be more easily solved by D. B. Steinman's method ("Simple Formula Solves All Higher-Degree Equations," CIVIL ENGINEERING, February 1951, p. 44).

With the value of k known, the total force in the anchor bolts can be found by taking the center of the moments at a distance of $dk/3$ from the edge of the base plate, as follows:

$$F_s\, jd = N\,[(e_1 - d) + (dk/3)]$$

$$F_s = \frac{30{,}000(32 + 3.45)}{23.5 - 3.45} = 53{,}200 \text{ lb}$$

$$f'_s = \frac{53{,}200}{2.67} = 19{,}900 \text{ psi}$$

By substituting in Eq. 1,

$$f_c = \frac{(53{,}200 + 30{,}000)2}{0.44 \times 23.5 \times 17} = 950 \text{ psi}$$

The same results can be obtained more quickly by using the chart, Fig. 2, which is reprinted through the courtesy of the late Dean F. E. Turneaure, Hon. M. ASCE, of the University of Wisconsin. Since enough information is available to get C_s and C_c for d/e_1 = 0.423 and pn = 0.1106, we get C_s = 7 and C_c = 5.4. Then

$$f_c = 5.4\left[\frac{30{,}000 \times 55.5}{17 \times (23.5)^2}\right] = 950 \text{ psi}$$

$$f'_s = 7 \times 12\left[\frac{30{,}000 \times 55.5}{17 \times (23.5)^2}\right] = 14{,}600 \text{ psi on gross area}$$

$$f_s = 14{,}600 \times \frac{3.68}{2.67} = 20{,}300 \text{ psi at root of threads}$$

The second method gives a good check on the first.

The designing engineer should investigate the anchor bolts at a section taken at the top of the base plate if the angles are not milled to bear on the base plate. For connections similar to the one in Fig. 1, and where the angles are not bearing on the base plate, the critical section for the anchor bolts is likely to be at the top of the base plate.

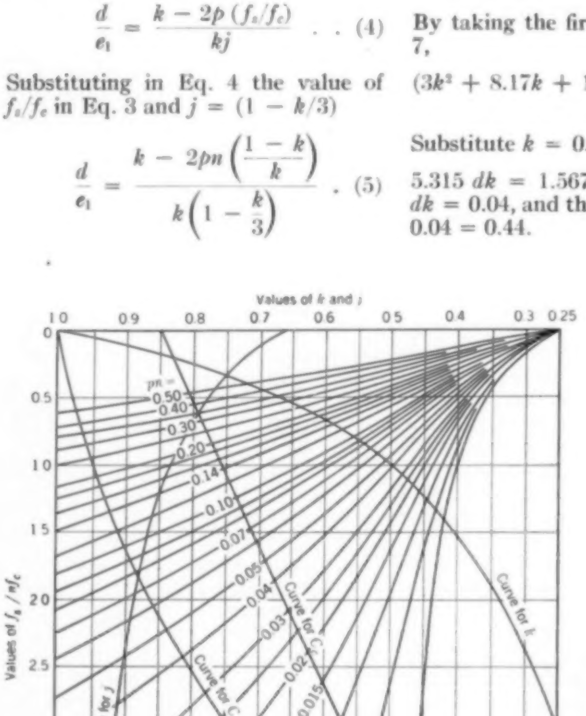
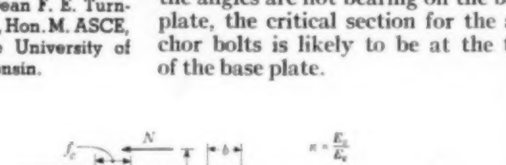


FIG. 2. Chart for design of concrete beams is reproduced by courtesy of the late Dean F. E. Turneaure, Hon. M. ASCE, of the University of Wisconsin.



THE READERS WRITE

Public Relations Has Role in Future of Profession

To the Editor: "The advancement of the profession is a matter for the individual" was the premise on which Mr. R. B. Macfarlane based his forthright letter published in your February 1952 issue (page 52).

This is absolutely true of course—no group prospers whose house is not first in order. But it is also true that, having put one's house in order, one must invite the neighbors in if due credit is to ensue. Invitations, open houses and, in general, the staging and presentation of the engineers' "house" are best accomplished with the help of professionals, who guide the ordering of the "house" from a public relations point of view.

The wisest of our great industrialists, rugged individualists all, recognized a fundamental of public relations—the people have to be told. Today few professional societies flourish without expert public relations assistance. The application of public relations to the engineering profession, and our vital need for it, would tax the available space of this publication.

K. N. Cundall, A.M. ASCE
American Bitumuls & Asphalt Co.
Alameda, Calif.

Blasting Force Can Be Accurately Determined

To the Editor: I read Mr. Sadler's article in the May issue, "Users of Explosives Are Liable for All Damage," with a great deal of interest, finding the reasoning behind most of the legal opinion perfectly logical. However, I would be greatly alarmed as a contractor by the ruling of the Connecticut court mentioned, to the effect that "a real force passed from the blast to the hotel causing damage" without specific information as to the method employed during the proceedings to determine the actual magnitude of this force.

During many investigations connected with cases of this character I have found that the forces transmitted beyond the actual area of well conducted blasting operations are more imaginary than real, but their magnitude can be determined with exactitude from seismograph recordings and from these recordings their potentiality may be calculated accurately.

The science of vibration analysis has long passed the stage in which decisions based upon the testimony of hysterical witnesses can be handed down to combat engineering facts. Recording, measurement and analysis of the alleged vibratory effect places sufficient proof on the record for a just determination of damage where it has occurred as well as for the discouragement of racketeers whose successful efforts in the courts have done so much to increase construction costs in settled areas.

Harold H. White, M. ASCE
Consulting Mining Engineer
Hazleton, Pa.

Design of Eccentrically Loaded Columns Discussed

To the Editor: The writers wish to thank those who have taken the time to discuss their article on the design of eccentrically loaded steel columns in the December issue.

The purpose in deriving the new formula was to obtain from basic concepts a general equation which would serve as a design device for the rapid selection of a trial cross section that would satisfy with little or no modification the requirements of any specific code applied as a review device. It was demonstrated that Eq. 7 is identical with the requirements of one code (AISC 1946) for $(Ld/bt) \leq 600$, but it was not the intent of the article to imply that it is identical with the requirements of every code.

As a matter of fact, the authors have used in their classes a modified form of Eq. 7 which does cover the AISC 1946 code for all values of Ld/bt and will serve any other code where torsional and lateral deflection effects are cared for by additional stress limitations on bending about the principal axes. This second equation is obtained by multiplying the second and third terms of the numerator of Eq. 7 by amplifying ratios similar to the one appearing in the first term of the numerator. The resulting formula is

$$\text{Required } A = \frac{P_e\left(\frac{s_{max}}{s_c}\right) + M_xB_x\left(\frac{s_{max}}{s_{bx}}\right) + M_yB_y\left(\frac{s_{max}}{s_{by}}\right)}{s_{max}} = \frac{P'}{s_{max}} \quad \text{(8)}$$

where s_{bx} and s_{by} are respectively the maximum fiber stresses (other than s_{max} for ordinary bending) permitted by the code in use for bending about the x-x and y-y axes. In the application of Eq. 8 to the AISC 1946 code for values of Ld/bt over 600, s_{bx} would be equal to $\frac{12{,}000{,}000}{Ld/bt}$. However, Eq. 7 is preferable for design because there is no necessity for assuming values for s_{bx} and s_{by} if they differ from s_{max}.

Aside from the fact that the AISC 1946 code requires it, and that Eq. 8 cares for it, the authors feel (as indicated in the original article) that the use of the amplifying ratio in the second term of the numerator of Eq. 8 is not really necessary and that the area provided without the ratio is adequate (though not in conformity with the code). It seems that if the AISC allowance for the lateral-torsional effect is valid for a beam with the usual types of end connections, it is certainly not valid in its entirety for a building column, because of the degree of restraint offered by the column connections. This is the reason for recommending Eq. 7 for all practical values of Ld/bt.

The equation which Professor Biggs presented (February 1952, p. 53) is theoretically correct but of no value for design because of its implicit nature. If the 14 WF 103 of the illustrative problem is reviewed under the AREA 1950 Specifications for Steel Railway Bridges, first by Eq. 7, with $s_{max} = 18$, and then by Professor Biggs' equation with L replaced by 0.75 L for riveted ends, and the other values in accordance with the stipulations of Appendix A of the specifications, the required areas are respectively 33.0 and 32.8. Such a close agreement certainly does not justify the use of a secant formula even for review.

The illustrative problem was concerned with a rolled section. When built-up sections are being designed, it is more convenient to substitute the equivalent

c_x/r_x^2 and c_y/r_y^2 for the values of B_x and B_y after the first estimate and selection of a trial section. If the built-up section is unsymmetrical, c_x and c_y must be referred to the fiber which is stressed to s_{max}. However, for the first estimate of built-up ribs, it is better to assume both B_x and B_y as 0.2, since separation of the ribs can make the two bending factors about equal.

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Not All Sands Follow Same Normal Size Distribution

TO THE EDITOR: The article by Professor Blench, "Normal Size Distribution Found in Samples of River-Bed Sand," in the February 1952 issue, deals with a subject which, although it has been discussed in other papers and textbooks, is not widely understood by engineers. Professor Blench's note contains several statements that can be amplified and several with which the writer does not agree.

Most investigators agree that the distribution very closely follows the normal or Gaussian distribution of statistics, if the logarithm of the sand size is used in place of the size D itself. Logarithmic probability paper, used by Professor Blench for his figure, is designed to yield a straight line when a normal distribution is plotted, provided of course that the quantity is normally distributed with respect to its logarithm. As a result, any straight line drawn on this paper represents a normal distribution, the mean of this distribution being given by the ordinate of the 50th percentile (D_{50}) and the standard deviation σ given by the difference between the 84.13th percentile ($D_{84.13}$) and the 50th percentile (or the difference between the 50th and 15.87th percentile). (D_{50} is equivalent to M in Mr. Blench's article, or to m_{50} inferred.) This definition of σ of a logarithmic normal distribution may be written

$$\sigma = \log D_{84.13} - \log D_{50} = \log \frac{D_{84.13}}{D_{50}}$$

Engineers generally use common logarithms (that is, to base 10), so unless otherwise specified these are used in this letter. Krumbein[1] has introduced his "φ scale" in which diameters are expressed by $\log_2 D$. In these terms σ (now written $\sigma\varphi$) is expressed by

$$\sigma\varphi = \log_2 \frac{D_{84.13}}{D_{50}}$$

The following relationship between σ and $\sigma\varphi$ can be readily obtained:

$$\sigma = \log_{10} 2 \times \sigma\varphi$$

The system of plotting used by Blench in his article forces all distributions to pass through one point, having the ordinate 50 percent and the abscissa 1.0 D/D_{50}. (D/D_{50} is equivalent to m/M given on Mr. Blench's Fig. 1.) This of course mechanically reduces the scatter of the distributions. In effect all distributions are shifted laterally to pass through this point, because of the logarithmic abscissa. Dividing all diameters by D_{50} shifts the curve but does not change its shape. Consequently, if Blench's assertion that all distributions follow the same line is true, all samples must have the same standard deviation, because σ is proportional to the slope of the line on probability paper. This result has not been borne out by experimental results. For example, samples collected in the Fraser River, British Columbia, have a range of σ from 0.2 to 0.8.

The distributions of three typical samples collected from the bed of the Fraser by the Department of Public Works, Canada, have been plotted in Fig. 1. These were analysed by the National Research Council of Canada and made available to the writer. It can be seen from this figure that Professor Blench's conclusion that the size distributions can be represented by a single straight line is incorrect for two reasons:

1. There is a wide divergence of σ.
2. None of the distributions are perfectly normal, although all are very close to being so.

This procedure of analysis and its complications have been described in detail by Krumbein and Pettijohn[2], Brown[3], and Rouse[4]. Professor Blench's article has served to bring this interesting subject to the notice of the profession.

W. DOUGLAS BAINES, J.M. ASCE
Research Officer, National Research Council, Canada

Vancouver, Canada

[1] Krumbein, W. C. "The Use of Quartile Measures in Describing and Comparing Sediments," *American Journal of Science*, Vol. 32, 1936.

[2] Krumbein, W. C., and Pettijohn, F. J. *Manual of Sedimentary Petrography*, D. Appleton-Century Co., 1938.

[3] Brown, C. B. "Sediment Transportation," Chapter XII of *Engineering Hydraulics*, John Wiley & Sons, N.Y., 1950.

[4] Rouse, H. *Fluid Mechanics for Hydraulic Engineers*, McGraw-Hill Book Co., Inc., N.Y., 1938.

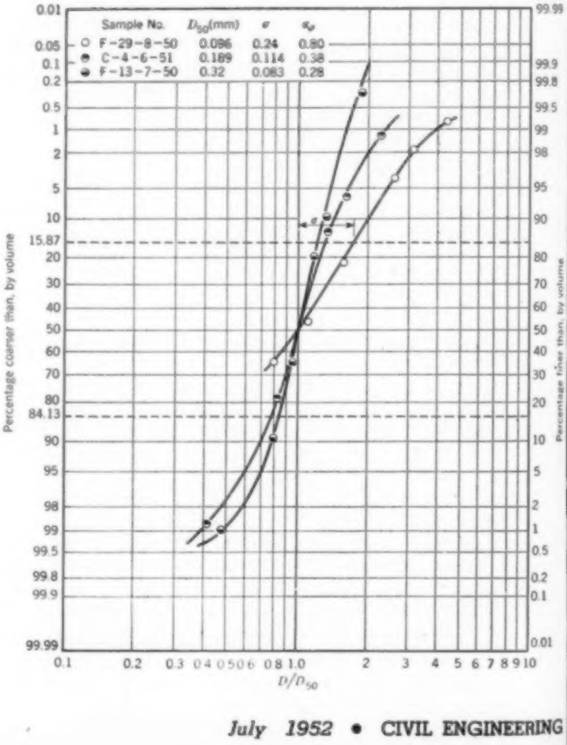

FIG. 1. Typical distribution curves show that river-bed sediment from Fraser River, British Columbia, has range of σ from 0.2 to 0.8.

The Surveyor's Notebook

Reporting on Unusual Surveying Problems and Their Solutions

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Doing Something about the Weather

"I quite agree with R. Getty Browning's recent statement in 'The Surveyor's Notebook'* that many phases of surveying have not kept pace with the increasing accuracy of instruments," writes L. Mabry Adams of Cleburne, Texas. "Weather is one factor which should be taken into consideration more often.

"For example, allowances can be made for the wind. Chainmen are carrying a weather vane while they are pulling the tape, *suspended,* since the resultant of the added pressure is felt by the direction and amount of sidesway of the tape from the vertical droop. Variables of pressures, angle of incidence, and flutter of the tape can all be cared for simultaneously in a correction of tension—derived by adding the product of the exsecant of the angle of sidesway *times* the tension of that portion of the tape used in still-weather measuring.

"When the sum of these reach the resultant of force of weight of the tape under the tension applied and directional force of the wind, the tape will begin a return swing—if not held by a steady pressure. Best results may be gaged by the maximum swing and tension coordinated at the instant of determination.

Near Cleburne, Texas, L. Mabry Adams' chaining crew snaps the sidesway in determining tension with wind allowances. Adams has used Gurley Transit 35 years.

Adams (at center of chained span) gives graduated offset-sight by horizontal measure as inspector (at stake beneath transit) applies tension to tension scale and reads awl-marked tack to nearest thousandth on temperature-scaled tape.

"Adopting such methods for Tension Control in Suspensory Measurements is an important adjunct to use of a good instrument. I grew up with, and have now been using Gurley Transits for 35 years. I have never found another transit I liked better on any job."

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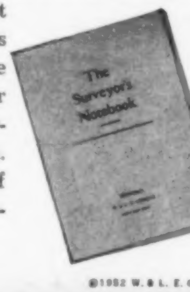

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SOCIETY NEWS

Colorado Section Is Host to Memorable Society Convention

Denver, called the Mile High City in its promotional literature, has become the mile high city in the esteem and appreciation of the 1,000 members and guests of ASCE fortunate enough to attend the Centennial Year Summer Convention, June 17–20. Hospitality and pace of program, both technical and social, assured the realization of the Colorado Section's hopes for a notable event. Walter E. Blomgren, president of the Section, and Alfred J. Ryan, general Convention chairman, headed hard-working committees of 250 men and women responsible for the successful outcome of the program.

Engineers and their families from 34 states and the District of Columbia, and from such foreign countries as Australia, Thailand, Venezuela, and British Columbia were welcomed by the governor of the state, Dan Thornton, and by Mayor Quigg Newton of Denver. Both paid generous tribute to the impressive contributions of civil engineers to the development of Colorado and Denver. Another feature of the Wednesday morning opening session was a talk by Arthur S. Horner, A.M. ASCE, Denver contractor and new president of the Associated General Contractors of America. Mr. Horner emphasized the happy relationship existing between the two organizations and said that such cooperation augurs well for the future of the construction industry. In his annual address (given on page 36 of this issue) and in a Rotary luncheon talk, President Carlton S. Proctor defined the engineer's role in a distressed world and called for the leadership of the profession in combating trends toward statism.

Welcoming ASCE members and their guests to Denver Convention, the Hon. Dan Thornton (bottom photo), governor of Colorado, and Mayor Quigg Newton of Denver (center), praise engineers "who have contributed so much to the development of the state and the city." ASCE President Carlton S. Proctor (top photo) responds for the Society. Shown with him are Mayor Quigg Newton and A. S. Horner (right) president of AGC, who also addressed Wednesday morning opening session.

Engineers Broadcast

Other talks delivered before Denver groups during the Convention week included a Kiwanis speech by ASCE Past-President Ernest E. Howard that described the triumph of engineering over Nature's obstacles. The alert local publicity staff, headed by J. S. Marshall, had arranged seven radio programs designed to familiarize the public with the accomplishments of the profession. Participants were G. Donald Kennedy, who spoke on traffic; Robert Horonjeff, on airport safety; Alfred J. Ryan and E. L. Chandler, on the Centennial; Harold Conkling, on soil conservation; G. Brooks Earnest, on opportunities in engineering; and Lawrence V. Sheridan, on suburban annexation. In addition, the Society and its Centennial plans were discussed in question-and-answer form on another hookup by President Proctor, Past-President Gail A. Hathaway, Vice-President A M Rawn, Directors Gordon H. Butler and James A. Higgs, and Colorado Section President Walter E. Blomgren.

Outstanding Technical Program

The many subjects on the agenda of the 15 sessions of the Society's Technical Divisions included a number of local projects, including the Denver-Boulder Turnpike, the Colorado-Big Thompson Project, the Denver Coliseum, the Denver sanitation system, Colorado's long-range highway plan, Denver's new traffic control system, the Granby Pumping Plant, and Granby Dam. The Boulder-Denver Turnpike paper—by R. L. Downing, professor of civil and architectural engineering at the University of Colorado, who has been called the "Father of the Turnpike"—is the lead article in this issue.

Following a custom initiated at the New Orleans Convention, a number of the Denver Convention technical papers had been preprinted prior to the Convention and were on sale during the meeting. A list of the papers available and an order blank are provided on page 96 of this issue.

Supplementing the technical program was a special session, held at the Denver Federal Center on Tuesday morning, June 17, to commemorate the semi-centennial of the U.S. Bureau of Reclamation. Among the speakers discussing the Bureau's half century of impres-

sive engineering achievement in the conservation and use of Western water supplies was Kenneth Markwell, M. ASCE, Assistant Commissioner of Reclamation, Washington, D.C. Mr. Markwell's paper is printed in this issue.

Innovations Prove Popular

Several innovations introduced by the host Section did much to increase the effectiveness of the program. One of these consisted of assigning a different local member, designated the "Man of the Day," to Convention headquarters each day to perform the myriad services of guidance and advice required in a smoothly run meeting. Similarly, a Division sponsor was assigned to each session to aid the presiding officer in any special need or emergency.

Perhaps the most popular innovation was the Children's Committee, conducted by Denver women under the chairmanship of Mrs. Harmon S. Meissner. Because of the services of this unique group, many young parents who cannot customarily attend Society Conventions came and, once in Denver, were able to enjoy the various events and make trips without worry about their children. The committee provided baby sitters for more than 25 families, arranged sightseeing bus trips for children up to ten years old, and provided companions and escorts for older boys and girls.

Social Program and Tours

The Ladies' Committee, capably headed by Mrs. Francis M. Bell, conducted tours, luncheons and other events, including a special trip to Central City, for the visiting ladies. The crowded program arranged by Emerson S. Ellett's Entertainment Committee came to a spectacular and awe-inspiring climax on the evening of Wednesday, June 18, in Red Rocks Park in the Rockies. Here in a natural open-air auditorium, flanked with a backdrop of red rocks and glimmering lakes, a program of Indian war dances, a cowboy quartet, and square dances was presented. Among other events were a "Family Luncheon" on the 20th, and a membership luncheon on the 19th, which was addressed by John Haney, a Colorado Springs attorney, on the amusing subject, "Defense of the Lazy Man."

Post-Convention tours to some of the West's most impressive engineering projects led also to many places of breathtaking beauty and historic and legendary importance—Central City, Boulder Canyon, Gregory Gulch Lode, the Colorado-Big Thompson Project, Estes Park, Trail Ridge Road, the Continental Divide, and Grant Lake, to mention a few. With many engineers and their families acting on the invitation of the Section to make the trip to Denver their vacation, these tours like all the other thoughtfully arranged features of Convention week were immensely popular.

Viewed at one of Authors' Breakfasts (upper photo, left to right) are ASCE Executive Secretary W. N. Carey, Convention Chairman A. J. Ryan, President Proctor, Section President W. E. Blomgren, and L. G. Yoder, U.S. District Engineer at St. Paul and author of paper on St. Anthony Falls Project. Section greetings are extended to group by Convention Chairman Ryan (small photo). With him are A. E. Perlman (seated left), executive vice-president of Denver, Rio Grande & Western Railroad, who addressed Wednesday morning meeting on "Our New Frontier," and Governor Dan Thornton.

Board of Direction Actions at Denver Briefed

Actions taken by the ASCE Board of Direction at its meeting in Denver are summarized here.

Committee on Professional Practice

A new Committee on Professional Practice was authorized. The duties of this committee, replacing the present Committee on Private Engineering Practice, will widen duties of the present committee to cover the principal general features of professional practice in addition to those of private practice.

First-Day Cover

An official "First-Day Cover" was approved for use with the ASCE commemorative three-cent stamp to be issued next September (item on page 69).

Insurance Plan for Juniors

A liberalization of the Society's group insurance plan for health and accident was approved so as to make available to Junior Members a less costly plan providing less coverage. See page 70.

Preprints

An appropriation of $600 was made to finance the cost of making preprints of Convention papers available at the time the paper is presented. The availability of preprints of the September ASCE meetings of Technical Divisions at Chicago is thus assured.

Unionization of Engineers

The Board noted revived efforts toward unionization of engineers in various parts of the nation and current inactivity of the ASCE Committee on Employment Conditions in this field. The President was instructed, in consultation with the President nominee, Vice-President Rawn and Director Steele, contact member of the Committee, to take such action as may be required to assure effective committee action in this field.

Local Section Conference

Approval was given for holding a ten-Section Local Section Conference and a

Closer cooperation between ASCE and construction industry is under discussion here. Participants are President Proctor, AGC President A. S. Horner, Convention chairman Ryan, and Executive Secretary Carey.

meeting of the Committee on Local Sections at the San Francisco Convention scheduled for February 1953.

Awards and Ceremonies

On recommendation of the Committee on Awards and Ceremonies, the Board approved a program for Society activities for Saturday, September 6, 1952, at Chicago. In brief, the annual awards for papers, etc., are planned for presentation at the Saturday noon luncheon meeting, and honorary member awards will be presented at the ASCE dinner that evening. The detailed program will be published in the August issue.

Nominating Committee Procedure

Changes in the Society's bylaws were approved to permit the Nominating Committee to name the official nominee for President at the June Convention each year instead of at the February Convention as presently provided.

Expansion of Society Services Studied

President Proctor reported that interest in the possibility of raising Society dues to permit expanded activity has been shown at most of the many Local Sections he has visited to date. The California Local Section Conference submitted a formal resolution on the subject. The Board voted that the President be empowered to appoint a task committee to consider what might be done to expand the Society's services to its members if additional funds were made available. The task committee was directed to consider separately each possible extension of service, its related expense and the increase in dues necessary to implement the service. The Committee was further directed to submit a preliminary report on the subject to the Board of Direction at its September 1952 meeting.

District Organization Studied

Two organizational subjects received extended consideration by the Board and resulted in the following actions.

(*a*) Each Director shall meet as soon as practicable with the Vice-President of his respective Zone to consider District and Zone problems, the formation and organization of District Councils and other subjects of Society interest.

(*b*) Each Director, in cooperation with his respective Vice-President, shall assume the responsibility of exploring the possibility of establishing sub-sections in his District, and report to the Board of Direction at its next meeting.

District and Zone Boundaries

No changes in present boundaries of Districts and Zones were proposed for this year by the Committee on Districts and Zones. It was agreed that a comprehensive study and report on this subject would be made by the Committee next year.

Appointments

Past-President Ernest E. Howard was appointed an ASCE delegate to the Fourth Congress of the International Association of Bridge and Structural Engineering to be held in Cambridge and London, England, next August. Mr. Howard will represent the Society at these meetings without cost to the Society.

A small appropriation was made to permit an organizational meeting of the ASCE representatives on a new Joint Committee for Advancement of Sanitary Engineering. The ASCE delegates recommended for the present, by the Sanitary Engineering Division for this Joint Committee were approved. They are Earnest W. Boyce, Thomas R. Camp and William A. Hardenberg.

District 7 Council Has Two-Day Conference

The Wisconsin Section was recently host to a highly successful two-day spring conference held in Milwaukee in conjunction with a meeting of the recently authorized District 7 Council. The program, under the chairmanship of Charles W. Yoder, featured talks on the Centennial by Frank W. Edwards, general manager of the Centennial of Engineering, Inc., and Gordon Butler, ASCE Director for District 7. Colonel Proctor spoke at a luncheon meeting in his honor, urging his hearers to participate more actively in the fight against totalitarian trends.

A tour of the Allis-Chalmers plant was climaxed by a dinner at the Allis-Chalmers Club House, at which the Hon. Frank Zeidler, mayor of Milwaukee, was the keynote speaker. Describing an atomic bomb detonation he had witnessed in New Mexico, Mr. Zeidler stressed the obligation of engineers to plan and design buildings and cities to withstand damage from bombs. Other tours took the group to the Blatz Brewery and the Milwaukee Filtration Plant.

A panel discussion on "High Water Levels and Erosion in the Great Lakes" comprised the technical program. Participants were Col. George Kumpe, of the Milwaukee District of the Corps of Engineers; Lt. Col. W. N. Harris, district engineer for the U. S. Lake Service; Melton P. Adams, executive secretary, Michigan State Water Resources Commission; and Eugene Howard, Milwaukee County Commissioner of Highways.

Preprints of Denver Papers May Be Ordered

A total of 18 preprints of technical papers, presented at the Denver Convention, June 17–20, are now available for general sale. Reproduced from authors' manuscripts without editing, these preprints supplement similar publications prepared for the New Orleans Convention in March, which have already had a wide sale. Other technical papers delivered at the Denver Convention were not made available in time for the advance printing.

A list of available preprints for both the Denver and New Orleans Conventions is given, together with a convenient order form, in the advertising section of this issue (page 96). There is a uniform charge of 25 cents a copy.

For Information on First-Day Centennial Covers, See Item on Page 69

Ladies' Program and Other Centennial Features Announced

Plans for the ladies' program at the Centennial Convocation and arrangements for participation of foreign engineers in the Centennial program are announced by Lenox R. Lohr, president of the Centennial of Engineering, Inc.

Ladies Program

As a headquarters for the visiting ladies, the Ladies Activities Committee, under the chairmanship of Mrs. Howard F. Peckworth, has arranged for a special Ladies Reception Room, to be open from 9 a.m. to 5 p.m., September 3 through September 13, except for Friday, September 5, when the closing time will be 6 p.m. Three or four hostesses will be on duty in the reception room during the stated hours, with a special hostess and linguists for the foreign ladies. There will be a general information desk staffed by a professional attendant and lecturer. Tickets for various radio shows, tours, etc., will be available at this desk. In addition, printed folders on points of interest and guide books will be provided.

Each day will start with a coffee hour, from 9:30 to 10:30, that will feature a 15-minute briefing by a special lecturer on Chicago and the program arranged for the day. Special functions including a luncheon on Thursday, September 4, in honor of the foreign ladies, the wives of Board members, and the wives of ASCE Past-Presidents, and a dinner and opera show at Kungsholms on Friday, September 5. Bus service to and from the Conrad Hilton will be available for both these events. On Monday, September 8, the ladies will be the guests of the radio show, "Welcome Traveler," at the Sherman Hotel. Coffee and doughnuts will be served. An afternoon tea, with entertainment in the form of either a lecturer or a book review, is scheduled for Tuesday, September 9, in the Ladies' Reception Room.

No effort is being spared to make the Convocation as much of a success for the ladies attending the Centennial as it will be for their husbands. In addition to the scheduled entertainment, which will be reported in greater detail in the August issue of Civil Engineering, there will be at their disposal all the resources of a great city in the way of sightseeing, recreation, and shopping. With the facilities being arranged for their convenience and comfort by the Ladies Activities Committee, a happy time for all will be almost axiomatic.

Foreign Engineers to Attend Convocation

The recent decision of the Mutual Security Agency to utilize the Centennial of Engineering to bring 200 leading European engineers to the United States to study American production methods will make the Convocation program truly international in scope. Present plans call for the foreign visitors to spend at least five weeks in this country. Prior to the Convocation, they will participate in a special two-day productivity seminar now tentatively arranged at the Museum of Science and Industry for August 31 and September 1.

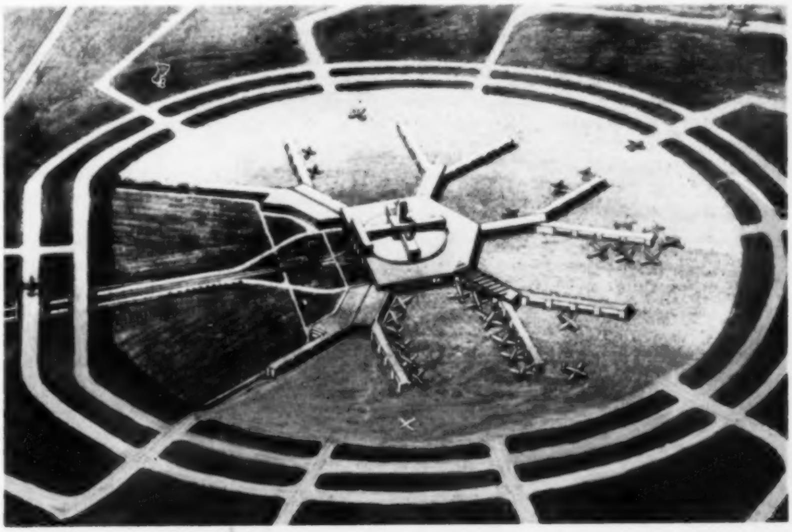
At the conclusion of the Convocation, the group will tour the leading cities and production centers of the country as well as other areas with key engineering installations. The principal objectives of the tour will be to give them every possible opportunity to observe American methods of design, construction, and operation of engineering works, mass production and distribution, and the roles of engineers, labor and management in the productivity of the United States. Actual direction of the visit will be conducted by the National Management Council, serving as an agency for the MSA.

In addition to the plans announced by the MSA, at least fifteen foreign nations will participate officially in the Convocation program. The largest single delegation (of seventeen members) so far announced will come from the Engineering Society of Norway. The Royal Society of Industrial Engineers, Belgium, will have an eleven-man delegation, while the combined group from Great Britain's Institution of Electrical Engineers, Institution of Civil Engineers, and Institution of Mechanical Engineers, is also expected to show a large representation. The British electrical engineers will be headed by Sir John Hacking.

Dr. Takeo Fukuda, of Tokyo University and vice-president elect of the Japan Society of Civil Engineers, will head his nation's delegation. France has chosen George Darrieus, president of its Society of Civil Engineers and member of the French Academy of Science, to lead its national group that will also include members of other French technical bodies. Other countries with assured representation from their scientific and engineering groups are The Netherlands, Switzerland, Italy, India, Canada, Mexico, Cuba, Peru, and Uruguay.

Program in August issue

The official program of Convocation events, including the meetings of all ASCE Technical Divisons, will be printed in the August issue.



Typical of many projects under construction in Chicago area that will be available for inspection by engineers attending Centennial of Engineering Convocation in Chicago, September 3–13, is O'Hare Field Terminal Building at Chicago's new international airport, Bensonville, Ill. Built in five split-finger structures extending from circular central concourse of main terminal building, project is destined to start new trend in loading and unloading of aircraft. When all five wings are completed, terminal will be able to handle 90 planes simultaneously. Consulting architects on this City of Chicago project are Skidmore, Owings, and Merrill. Photo courtesy of Otis Elevator Company.

Proceedings Separates—A Two-Year Review

W. N. CAREY, Executive Secretary ASCE

With the PROCEEDINGS Separates issued last February, the Society completed its first two years of experience with this form of technical publication. It will be recalled that a task committee for making such a study was appointed in 1947. This committee, headed by George W. Burpee of New York, made its final report to the Board of Direction in October 1949. Publication of PROCEEDINGS papers as separates was recommended and approved by the Board. The shift from the old method to the new Separates method was made with the February 1950 issue of PROCEEDINGS papers.

In compliance with Board of Direction instructions, study of publication procedures for our technical papers is being continued by the Society's Committee on Publications. The two-year period of Separates experience admittedly constitutes a very short record. Statistically it should at least indicate trends and afford checks on some of the cost estimates made by the task committee. Such information should be of value to the Publications Committee and to the members of the Society interested in PROCEEDINGS papers.

As all but the newest Junior Members will remember, prior to 1950 the Society published its PROCEEDINGS papers and discussions each year in ten issues of PROCEEDINGS mailed automatically, like CIVIL ENGINEERING, to every member. After 1930, when CIVIL ENGINEERING was established, three or four papers and discussions of earlier papers were carried in each issue of PROCEEDINGS. In 1948 there were 38 papers published, and the yearly average for the six-year period, 1943 to 1948 inclusive, was also 38. Delays between receipt and publication of papers ran from 18 to 24 months, and sometimes longer. Because of these generally unsatisfactory conditions, the task committee was instructed, "to determine whether it is possible to give the quality and quantity of the technical papers they desire but by a less costly method than the present." The change to Separates was made on recommendation of the task committee to meet this objective.

The short two-year record during which PROCEEDINGS papers have been issued as Separates indicates an impressive increase in the number of papers published annually. During these two years 114 Separates were issued, an average of 57 papers per year compared with the previously mentioned average of 38 papers per year under the old system. The year 1948 just made the 38-paper average of the six-year period ending that year. In 1951, the second of the two-year period of Separates, 61 PROCEEDINGS papers were published.

Concurrent with the increase in the number of original papers published, there has been a decrease in the number of discussions submitted, to about 60 percent of the output under the former system. This decrease in the volume of discussions doubtless is due in part to the Separates procedure. Part of the reduction also is due to a revision of publication policies regarding discussions which are now given the same screening tests as original papers.

Under the former method of publication every member received all PROCEEDINGS papers, ten volumes each year, whether or not he was interested in all the papers. The PROCEEDINGS papers and discussions, published in ten issues each year, were then assembled and reprinted in an annual volume of TRANSACTIONS. Some members retained the PROCEEDINGS for permanent record and did not order TRANSACTIONS. A survey conducted by the task committee indicated that a relatively large number of members paid scant attention to many of the papers as issued in PROCEEDINGS but waited to obtain the annual TRANSACTIONS for their records.

Under the current method of issuing PROCEEDINGS papers as Separates all papers are available to all members as before, with the difference that members receive only those Separates in which they indicate interest. Any member can obtain 40 Separates annually without additional cost. This is two more papers than the average available annually during the six-year period just before the change to Separates was made. Any member who wishes all Separates automatically mailed to him, regardless of number and subject, can make such arrangement for a fixed subscription price. If he does not wish to receive all of them each year but does require more than 40, he can obtain additional Separates in excess of 40 at 25 cents a copy.

All the papers issued as Separates and all the discussions thereon are assembled into yearly volumes of TRANSACTIONS, which are available on order as heretofore. During the past two years standing orders for TRANSACTIONS, have increased about 10 percent to a present total of approximately 13,000. The net income or profit for TRANSACTIONS as budgeted for 1952 is $7,200.

In its final report to the Board of Direction in 1949, the task committee set a goal of 100 PROCEEDINGS Separates to be published annually. It was anticipated that it might take several years to reach that total. The change from 38 papers under the old system in 1948 to 61 papers under the Separates system in 1951 indicates a rapid advance toward that goal. The rapid increase in the number of papers which has been accomplished through the Separates method indicates that the Society is well on its way toward giving "the members the quality and quantity of technical papers they desire." The other basic factor in this consideration is cost.

The task committee estimated that an annual total of 100 PROCEEDINGS papers, with their discussions, would probably comprise about 3,000 pages. Fortunately for checking purposes, the total number of pages printed in the first two years of Separates was approximately 3,000 pages for 114 papers. The cost to the Society to produce the 3,000 pages of Separates during 1950 and 1951 was $120,907, say $121,000.

The estimates of the task committee for 100 Separates, as given in its final report of October 1949, was $88,730. It was estimated that this sum would cover paper, printing, mailing and payroll for a 100-paper (3,000-page) year of Separates. The estimated annual payroll in this case was $30,000. The actual payroll for the two years 1950 and 1951 chargeable to Separates has approximated $31,000 per year. To place the two-year Separates record of 3,000 pages on a one-year basis it is necessary only to deduct the payroll for one year from the total overall cost of producing 3,000 pages. Deducting one year's payroll, $31,000 from the total cost, $121,000, we find the actual cost of producing 3,000 pages of Separates in one year to be $90,000. This is a reasonably close check on the estimate of $88,700 contained in the report of the task committee.

It may be argued that the Society headquarters could not have produced 3,000 pages of Separates in one year with the same payroll actually used to produce half that amount in the same time. When it made its report the task committee was of the opinion that a payroll on the order of $30,000 annually would be ample to cover the handling of PROCEEDINGS papers, provided the Technical Divisions would do their part of the job planned for them, which responsibility they accepted. The past two years has been a transition period so far as the Technical Divisions are concerned. Their record indicates that they are rapidly assuming their full load in the program for producing more and better technical papers at the lowest possible cost. With all the Technical Divisions doing their share of the work, there appears no reason to believe that the payroll

estimate for a 100-paper year is materially out of line.

The current system of issuing PROCEEDINGS as Separates not only makes available to members many more papers at lower cost than was possible under the old system, but has increased income from the sale of papers. For example, in fiscal 1948 and 1949, under the old system, total sales for PROCEEDINGS came to $17,400. During the two-year period under the Separates procedure, the total income from sale of Separates papers approximated $23,300. Separate papers are more saleable than were separate volumes of PROCEEDINGS. There appears to be no reason why the sale of Separates cannot be stimulated and the income from that source increased. Such increase in income would go a long way toward offsetting the production cost of the annual 100-paper goal.

The cost of printing and distributing 3,000 pages of papers and discussions, under the old system of ten volumes of PROCEEDINGS annually under costs prevailing in 1948, was estimated by the task committee at $138,000. Present-day costs would bring this figure to approximately $146,000, which is comparable with the $90,000 estimate earlier cited to cover the cost of producing 3,000 pages of Separates in one year. This leaves an approximate monetary advantage in favor of Separates of about $56,000 annually, based on costs alone.

The increased saleability of Separates over that of separate volumes of the old-style PROCEEDINGS is another factor worthy of consideration. For the last two-year period covering the old-style PROCEEDINGS compared with the first two-year period of Separates, the increase in sales was better than $6,000 or an increase of about 33 percent. With 100 papers a year available for purchase as Separates compared with any possible sales arrangement covering the same number of papers under the old PROCEEDINGS system, the difference in annual income should be much greater than $3,000 a year. It might easily be two or three times that amount. If it was as much as $9,000, it would be fair to add that amount to the $56,000 difference mentioned before, making the actual difference $65,000 annually in favor of the Separates system. A difference of $60,000 would be a most conservative figure.

Experience of the past two years has proved that technical papers may be distributed by a less costly method than that previously used by the Society. In fact, the experience of the first two years with Separates has demonstrated that the request of the Board of Direction to the task committee in 1948, as quoted below has been carried out. The Separates method has made it "possible to give the members the quality and quantity of the technical papers they desire but at a less costly method than the old system."

The ASCE Publications Committee and the Board of Direction are continuing to study the problem of technical publications. After the first two years of Separates, they want to know what the members of the Society think of the procedure. For that purpose a self-addressed permit-type postcard will be enclosed in the envelope to be sent to each member shortly after August 1 with notification of official nominees. The card will be printed as indicated above.

The Board of Direction and the Publications Committee hope that every member will give this subject his most earnest consideration and will return the postcard.

Proceedings Separates Information Wanted

Note: For background data see page 64 CIVIL ENGINEERING, July 1952, "Proceedings Separates—A Two-Year Review."

1. Are you satisfied with the present method of publication and distribution by Separates? Yes ☐ No ☐

2. If ten or twelve issues of PROCEEDINGS papers and discussion annually were again available without additional cost, as they were prior to 1951, would you request to be put on the mailing list to receive them automatically? Yes ☐ No ☐

3. Would you be willing to pay an annual subscription price for such PROCEEDINGS issues of

$3.00? Yes ☐ No ☐

Date and signature

Student Chapters Receive Committee Commendation

Special recognition of outstanding activities during 1951 has been awarded to Student Chapters of the Society in the form of 15 Certificates of Commendation and 26 letters of honorable mention, as recommended by the Committee on Student Chapters at its meeting in Tuscaloosa, Ala., in April. ASCE President Carlton Proctor approved the recommendations, and has signed and transmitted the certificates and letters.

Certificates of Commendation were awarded to Student Chapters at the following colleges and universities:

Northeastern University (7th time)
Cooper Union (4th time)
Massachusetts Institute of Technology (3rd time)
Bucknell University (3rd time)
University of Dayton (5th time)
Lehigh University (2nd time)
South Dakota State College (4th time)
Iowa State College (10th time)
University of Kansas (5th time)
Virginia Military Institute (16th time)
University of Alabama (2nd time)
Mississippi State College (1st time)
California Institute of Technology (4th time)
University of Arizona (3rd time)
University of California (7th time)

Student Chapters receiving the President's Letter of Honorable Mention were as follows:

New York University
College of the City of New York
Worcester Polytechnic Institute
Swarthmore College
Rutgers University
Johns Hopkins University
Carnegie Institute of Technology
Newark College of Engineering
Wayne University
University of Missouri
Kansas State College
University of Wisconsin
Michigan State College
Purdue University
University of Florida
Duke University
University of Louisville
Louisiana Polytechnic Institute
George Washington University
Tulane University
Texas Technological College
University of Colorado
University of Southern California
University of Nevada
Santa Clara University
University of Washington

U.S. and Latin-American Engineers Plan UPADI Convention

Latest reports indicate that the second Convention of UPADI (Union Panamericana de Asociaciones de Ingenieros), to be held in New Orleans, La., August 25–30, will attract several hundred engineers from professional societies throughout Central and South America. The time and place were chosen to bring the Latin-American engineers to the United States in time for participation in the ASCE Centennial of Engineering Convocation in Chicago early in September.

A relatively new organization, UPADI was formed to provide a common meeting ground for Western Hemisphere engineers and a clearing house for discussion of their mutual problems. ASCE and the other Founder Societies take part in UPADI activities through Engineers Joint Council.

Reading counterclockwise are James M. Todd, chairman of special committee set up to handle UPADI conference, and ASCE delegation consisting of E. A. Pratt, ASCE President Carlton S. Proctor, Past-President Gail A. Hathaway, and Executive Secretary William N. Carey.

The first UPADI Congress, held in Rio de Janeiro, Brazil, in July 1949, was attended by representatives of most of the Latin-American societies and EJC official observers. A number of papers were presented at the Rio de Janeiro meeting, and a provisional constitution was drawn up. The constitution was negotiated and revised after the congress and adopted on a temporary basis at a subsequent convention in Havana, Cuba, in April 1951. Shortly after the Havana Convention EJC became affiliated with the organization.

The forthcoming convention in New Orleans will consider further revision of the constitution and adoption of a set of by-laws. There will also be an all-day technical program on the theme of engineering education on August 26. This program which is being developed by Leo J. Lassalle, dean of the College of Engineering at Louisiana State University, will explore the general philosophy of engineering education and the postgraduate training of engineers, with discussion of plans for expansion in the field.

Although much of the convention will of necessity be devoted to organization and business, arrangements are being made to inspect the facilities of the Port of New Orleans, which are second to none, and to visit industrial plants in the New Orleans area. The various social events scheduled include a formal banquet on August 29 and a special program for the visiting ladies.

Headquarters for the convention will be Tulane University, with air-conditioned McAlister Auditorium the center of convention activities. Living quarters for the delegates will be provided on the Tulane campus. A special UPADI committee has been set up under the chairmanship of James M. Todd to handle details of the convention, and each Local Section of the Founder Societies and the AIChE in the area has a member on the committees.

UPADI officers are Luis Giannattasio, of Montevideo, Uruguay, president through 1954; James M. Todd, of New Orleans, vice-president; and Manual J. Puente, of Havana, Cuba, treasurer. Representatives of societies in Argentina, Brazil, Canada, Colombia, El Salvador, and Honduras make up the board of directors.

Delegates to the convention appointed by the EJC constituent societies are as follows:

ASCE: E. A. Pratt, consulting engineer, New York, N.Y.; Past-President Gail A. Hathaway, Department of the Army, Hyattsville, Md.; W. N. Carey, Executive Secretary of ASCE, New York, N.Y.; and President Carlton S. Proctor, consulting engineer, New York, N.Y.

AIME: Fred T. Agthe, Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.; W. H. Carson, Dean of Engineering, Univ. of Oklahoma, Norman, Okla.; and Sherwin F. Kelly, Sherwin F. Kelly Geophysical Services, Amawalk, N.Y.

ASME: Joseph Pope, Stone & Webster Engineering Co., New York, N.Y.; A. J. Ackerman, consulting engineer, Madison, Wis.; J. M. Todd, consulting engineer, New Orleans 16, La.; and J. W. Cox, consulting engineer, New York, N.Y.

AIEE: T. G. LeClair, Commonwealth Edison Co., Chicago 90, Ill.; Ernest Pragst, International General Electric Co., Schenectady, N.Y.; and F. S. Black, Editor, *Electrical World*, New York 18, N.Y.

AIChE: Dr. K. H. Kobe, Chemical Engrg. Dept., Univ. of Texas, Austin 12, Tex.; W. D. Kohlins, Buflovak Equipment Div., Blaw-Knox Co., New York, N.Y.; Dr. T. H. Chilton, DuPont de Nemours & Co., Wilmington, Del.; and S. L. Tyler, Secretary, AIChE, New York, N.Y.

Tentative UPADI Program

Monday, August 25

Morning—Registration
Luncheon—Welcome
Afternoon—Plenary session
Summary of developments since Havana
Conferences by committees to complete their reports
Evening—Meeting of Board of Directors

Tuesday, August 26

Morning—Papers on Engineering Education by Latin-American delegates
Luncheon—Speaker on Engineering Education
Afternoon—Program similar to morning session with U. S. and Canadian papers
Evening—Informal exchange of greetings by representatives of various delegations

Wednesday, August 27

Morning—Plenary session to receive and act on reports
Luncheon—Open
Afternoon—Continuation of morning session
Evening—Special entertainment for delegates

Thursday, August 28

Morning and afternoon—Port trip and other excursions
Evening—Open

Friday, August 29

Morning—Plenary session
Final action on committee reports
Resolutions
Luncheon—Open
Afternoon—Panel discussion on engineering aspects of industrial developments and financing in Latin America
Evening—Formal banquet

Saturday, August 30

Morning—Concluding business and ceremonies

FROM THE NATION'S CAPITAL

JOSEPH H. EHLERS, M. ASCE — Field Representative ASCE

Congress is expected to recess for the greater part of July and to return sometime in August to clean up outstanding business.

"Wunderlich Case" legislation

Senator McCarran's bill (S.2487) designed to counteract the Supreme Court decision in the Wunderlich Case (see CIVIL ENGINEERING for April, page 64) was reported out of the Senate Judiciary Committee. This bill is expected to pass the Senate. It gets around the difficulty resulting from the objectionable disputes clause in government contracts by directing agency heads not to plead the Wunderlich decision as a defense when a case arises in the Court of Claims.

The principal section of the bill as approved reads:

> "That no provision of any contract entered into by the United States, relating to the finality or conclusiveness, in a dispute involving a question arising under such contract, of any decision of an administrative official, representative, or board, shall be pleaded as limiting judicial review of any such decision to cases in which fraud by such official, representative, or board is alleged; and any such provision shall be void with respect to any such decision which the General Accounting Office or a court, having jurisdiction, finds fraudulent, grossly erroneous, so mistaken as necessarily to imply bad faith, or not supported by reliable, probative, and substantial evidence."

Another legislative approach to achieve the same end has been to tack on to the Defense Department appropriation bill a section specifically forbidding the use of any funds voted in the act "for the purpose of entering into construction under Article 15" (the present disputes clause in government contracts). The Defense Department appropriation has already passed the House with no opposition registered to the rider.

Amendments to Defense Production Act

Some interesting maneuvering took place in connection with a provision exempting engineers from the salary stabilization provisions of the Defense Production Act. As originally drafted, the provision excluded only registered engineers employed by engineering firms. The Senate Banking Committee voted favorably on a provision to exempt all professional engineers, whether registered or not, when employed by an engineering firm. On the Senate floor an attempt was made to strike out the exemption for engineers, but the final result was the passage of a bill exempting all professional engineers regardless of where employed. Meanwhile officials of the Salary Stabilization Board have expressed disapproval of the idea of exempting engineers from the Board's jurisdiction and will oppose this feature of the bill as passed by the Senate. The House Committee has reported out a bill making no reference to engineers.*

St. Lawrence Seaway

After months of hearings and committee study, the Senate voted by a close margin to shelve the St. Lawrence River Seaway and Power Project by sending the bills back to committee. President Truman had written that it would be one of the nation's worst economic mistakes to let the project fail by default. One Senator has asked for a reconsideration. Following the recommital, a new resolution, S. J. Res. 167, which would permit interested states to form compacts with Canada to build the seaway if the United States became a party to the agreement, was referred to the Senate Public Works Committee.

DPA Controls

Self-authorization for increased amounts of copper and aluminum are permitted. For many types of public works projects 750 lb of copper per project and 1,000 lb of aluminum may be self-authorized. Builders of industrial plants may self-certify up to 2,000 lb of aluminum per project. The ban on recreational construction is lifted, and self-authorization of some scarce metals is permitted. It appears that copper and aluminum will cease to be limiting factors in construction after the third quarter of 1952. Details of the changes in regulations are given in CMP Reg. 1, Dir. 1; Revised CMP Reg 6; and M-100, all as amended June 18, 1952.

The NPA Construction Advisory Committee in a recent meeting with government officials recommended further liberalizations. NPA officials stated that requirements for the fourth quarter are still in excess of the available supply, structural steel demand being 40 percent over and copper 35 percent because of continuing needs for industrial expansion.

In the Facilities Expansion Program, there are signs of a shift in emphasis from basic materials facilities to such items as public utilities and oil pipelines. The total expansion in production of basic materials contemplated by the program is enormous. New steel facilities will produce more steel than the total production of most countries. Aluminum production is expected to rise by 1954 to $1^1/_2$ million tons as compared with a World War II peak of considerably less than 1 million tons. Cement production will be up 6 million barrels a year. The production of exterior plywood will be up 70 percent.

Executive Department Matters

The Field Representative represented the Society at a State Department conference on U. S. Foreign Policy which was attended by delegates of over a hundred organizations. The objectives of the Mutual Security Agency and the Point IV Program were fully discussed. There were briefings on current military and economic matters which affect our foreign policy.

The Mutual Security Agency is planning to bring 200 leading engineers to the United States for a study of American production methods and for participation in the Centennial convocation. This action followed intensive efforts by the Society and personal visits by the Executive Secretary and others at MSA Headquarters.

The President signed into law the $\$6^1/_2$-billion dollar foreign aid appropriation bill for fiscal 1953. The amount is nearly $\$1^1/_2$ billion less than requested.

AIA Meeting Features Engineering

At the annual AIA convention on June 24 there was an exhibit entitled "Re-Union of Architecture and Engineering" to mark the ASCE Centennial. President Proctor addressed the gathering.

Washington, D.C.
June 24, 1952

* The law as passed June 28 exempts all professional engineers employed in a professional capacity.

ASCE MEMBERSHIP AS OF JUNE 9, 1952

Members	8,133
Associate Members	10,354
Junior Members	16,251
Affiliates	68
Honorary Members	37
Total	34,843
(June 8, 1951	32,424)

ASCE Student Chapters Sponsor Regional Spring Conferences

During the Spring just past, ASCE Student Chapters in all parts of the country sponsored large-scale regional conferences, which served as a clearing house for discussion of vocational and professional problems. Reports received from several of these conferences—the California, the North Central, the Philadelphia-Lehigh Valley, the Rocky Mountain, and Virginia—are either briefed here or represented pictorially.

Cadet C. G. Redman, of VMI (left), delivers prize-winning paper on "How to Keep a Job and Turn It Into a Better One" at Virginia Student Conference at VMI. Upper left view shows Alfred Westfall (left) head of English Department at Colorado A & M College, presenting prize to Donald Daines, of Utah State Agricultural College, winner of undergraduate prize paper contest at Rocky Mountain Conference. Winner of graduate prize paper contest was Rodney Page, of University of Colorado.

California Conference

The University of Southern California and San Diego State College were co-hosts to the Fifth Annual Conference of the California Council of Student Chapters, held in San Diego in conjunction with the recent California Conference of Local Sections. Winners in annual prize paper contest, a traditional conference feature, were Waheed Ghauri, of the California Institute of Technology, who received first prize for a paper on "Rainfall Augmentation by Artificial Nucleation," and Harold Wilson, of the University of Arizona, who received second prize for his study of "The Panama Canal—a Sea Level Project."

The crowded three-day program included addresses by ASCE President Carlton S. Proctor and Executive Secretary W. N. Carey, who discussed the Centennial of Engineering; Mayor John D. Butler, of San Diego, who stressed the city's need for engineers; and F. T. Letchfield, who spoke on the value of human relationships. Conference chairman was Dale Diamond, of the University of Southern California.

North Central Conference

Ten schools sent delegates to the two-day North Central Conference of Chapters held at Ohio State University. First prize in the student paper contest went to W.J. McDermott and Irvin H. Sturm, of the University of California, for a joint paper on "Construction and Testing of Reinforced Concrete Lintels," and second prize to Felix G. Andrews, of the University of Dayton, for a paper on "The Erosion Problem in the Vicinity of Point Lookout, N.Y." The opportunities for young engineers and their responsibility to the profession and the world constituted the subject of a major talk given by President Proctor. The two-day program also included field trips to Lockbourne Air Base and Delaware Dam.

Philadelphia–Lehigh Valley Conference

Pennsylvania State College was host this year to the fourteenth annual conference of Chapters in the Philadelphia and Lehigh Valley Sections, which was attended by 200 delegates. Speakers included Eric A. Walker, dean of the Engineering College at Penn State; ASCE Director Francis S. Friel; Samuel S. Baxter, Philadelphia Section president; and Joseph W. Eney, president of the Lehigh Valley Section. First prize in the technical paper contest went to William A. Sech, of Villanova, and second prize to Laurie W. Seaman, of Swarthmore College.

Rocky Mountain Conference

More than 125 delegates attended the Rocky Mountain Conference, to which Colorado A & M College was host. Ivan C. Crawford, consultant to the School of Engineering at Denver University and former dean of engineering at the University of Michigan, addressed the group at a noon luncheon on "The Engineer of the Future." Another feature of the program was a guided tour of the plant of the Ideal Cement Company at La Porte, Colo. Winners in the annual prize paper contest are indicated in the accompanying photo and caption.

Delegates attending North Central Conference at Ohio State University are shown here. University of Detroit and Wayne University will be joint hosts to 1953 conference of group.

Society Approves Plans for First-Day Covers

With completion of the design for the special commemorative three-cent stamp in honor of the one-hundredth anniversary of the founding of ASCE at hand, the Executive Committee of the Board of Direction has reviewed plans for special engraved envelopes or covers for use in first-day mailings of the stamp. Of several designs submitted by firms engaged in the manufacture of such envelopes, official choice for first-day cover went to a design developed by the Fleetwood Cover Service of Pleasantville, N.Y. The company is headed by E. Milnor Peck, who has created official first-day covers for a number of important events.

The cover design chosen symbolically indicates the century of engineered progress. An engineer's hands manipulating a compass, a sketch of a suspension bridge, and the shield of the American Society of Civil Engineers are the major features of the design, which occupies a substantial area of the left-hand side of the cover. Mr. Peck has included an appropriate quotation from Ruskin: "Therefore when we build, let us think that we build forever."

The combination of a special stamp honoring the Society and the first-day cover described constitute a fitting tribute to the oldest national engineering society in the United States. With the number of commemorative stamps issued by the United States drastically curtailed this year, it is particularly significant that the achievements of the Society should be honored by one of the few commemorative stamps issued. It is believed that when the final design of the stamp is revealed, it will be found a notable symbolization of the principles and accomplishments of the Society.

The Society will not handle or receive orders for the first-day cover. Orders and inquiries must be addressed to Mr. E. Milnor Peck, Fleetwood Cover Service, Pleasantville, N.Y., who will handle issuance. Orders, together with names and addresses, must be in his hands by September 1, and he will see to the first-day mailing from Chicago. To avoid difficulty with cancelling machines, envelopes must contain enclosures. Enclosures may be sent to Mr. Peck, or if preferred, he will furnish them—he is expected to use a card bearing greetings from the ASCE. Mr. Peck's staff will address and stuff envelopes, take them to Chicago where he will set up headquarters, attach first-day stamps, and see to the mailing on the first day.

The cost of first-day covers, including stuffing, addressing, first-day stamp and mailing from Chicago on "first day of issue" will be as follows: Singles at 20 cents; six singles at \$1.00; 100 or more singles at \$12 per hundred; block of four stamps, on first-day cover, 30 cents; plate number, block of four stamps in cover, first day, 60 cents.

Those wishing to purchase engraved envelopes without having them handled by Mr. Peck's staff may obtain them from the Fleetwood Cover Service at the following rates: 100 for \$3.50; 500 for \$17.50; and 1,000 for \$32.50.

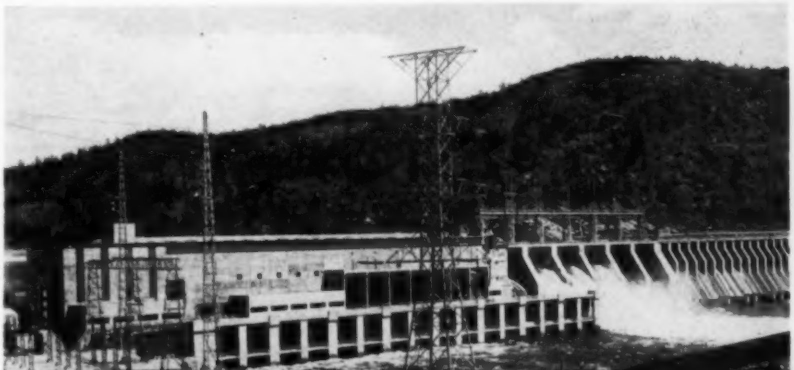
Again, please do not send orders or inquiries to Society headquarters. Address them to Mr. E. Milnor Peck, Head of Fleetwood Cover Service, Pleasantville, N.Y.

New Canadian Generating Station Honors ASCE Director Otto Holden

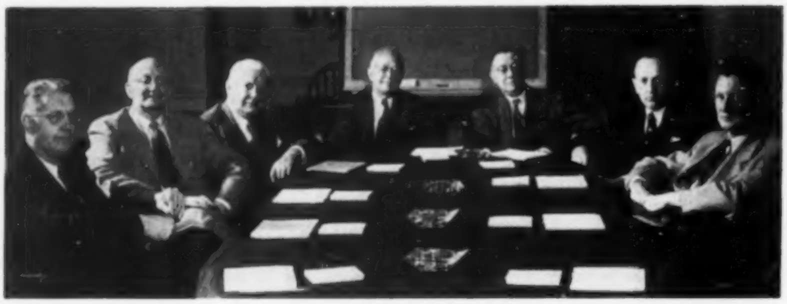
The newly opened Otto Holden Generating Station, a \$60,331,000 development on the Ottawa River in Canada, honors ASCE Director Otto Holden, assistant general manager of engineering for the Hydroelectric Power Commission of Ontario, builder of the project. At the official opening ceremonies on June 10, Carlton S. Proctor, ASCE President and official representative of the Society for the occasion, hailed the tribute to Mr. Holden as a unique, though well-deserved, honor in an age that is too prone to name its great structures after politicians rather than the engineers responsible for their design and construction. With the Commission since 1913, Mr. Holden was chief hydraulic engineer from 1937 to his appointment to his present position in 1947.

Mr. Proctor said that, as the great project joins the provinces of Ontario and Quebec, so in another sense it symbolizes the bond between Canada and the United States. The principal speaker at the opening ceremonies, which were attended by government officials representing the Dominion and the two provinces, was the Hon. Leslie M. Frost, prime minister of Ontario.

One of three major hydroelectric projects built on the Ottawa River in the Hydroelectric Power Commission's billion-dollar expansion program, the Otto Holden Generating Station will have a capacity of 204,000 kw (273,000 hp) at 60 cycles when completed early in 1953.



New \$60,331,000 Otto Holden Generating Plant on Ottawa River, which houses eight generating units, straddles interprovincial boundary and forms integral part of main-dam structure. Plant is named for ASCE Director Otto Holden (see photo above).



Greater cooperation between engineers and architects is objective of this recently established Joint Cooperative Committee of ASCE-AIA, shown at first meeting at AIA headquarters in Washington. From left to right are ASCE Director G. Brooks Earnest, Cleveland; Joseph H. Ehlers, ASCE Field Representative and co-secretary, Washington; Alvin E. Harley, AIA, Detroit; Craig P. Hazelet, ASCE co-chairman, Louisville; Director Leonard H. Bailey, AIA co-chairman, Oklahoma City; Mason G. Lockwood, ASCE, Houston; and Edmund R. Purves, AIA co-secretary, Washington. Roy F. Larson, AIA member of Philadelphia, was absent.

Reduced Rates Available to Junior Members in Group Disability Plan

Changes advantageous to the members of the ASCE group insurance disability plan worked out by Smith and Sternau, Inc., administrators of the plan, in cooperation with the Continental Casualty Company, to mark the third anniversary of ASCE participation in the plan, were approved by the Board of Direction at its Denver meeting.

The first of these changes, providing new benefits for Junior Members, was suggested by the fact that three-quarters of the applications received from the membership for the Group Disability Plan come from Members and Associate Members, whereas Junior Members comprise about 47 percent of the total ASCE membership. Deciding that the lag may be due to lack of buying power in the younger men, the administrators have arranged for lower rates for Junior Members to enable them to participate in the plan as fully as the older members. The change is of great potential importance to Junior Members since disability insurance should be of greatest value to the engineer in his early years when he is bringing up his family.

The reduced rates to Junior Members will be made available as of August 1, and all Junior Members who are now holding contracts under the regular plan will be transferred from their present contract on the premium-due date to the new Junior Member contract. The rate for the Junior Member contract will prevail only until Junior Members reach age 32, when the premium will automatically increase to the regular rate.

Under Junior Plan A, the weekly indemnity is \$50, the principal sum \$2,000, annual premium \$66 and semiannual premium \$33.50. Under Junior Plan B, the weekly indemnity is \$25, the principal sum \$1,000, annual premium \$33 and semiannual premium \$17.

Another change provides increased weekly benefits for those desirous of receiving them. These possible benefits, arranged to meet the suggestion of members that \$50 a week is not adequate coverage for a disabled person under today's high cost of living, will be limited to the following age groups:

\$100 weekly will be available only to male members under age 55. Principal sum, \$5,000; annual premium \$154, semiannual \$77.50.

\$75 weekly will be available only to male members under age 60. Principal sum, \$5,000; annual premium \$118, semiannual \$59.50.

\$50 weekly will be available to members up to age 65. Principal sum, \$5,000; annual premium \$82, semiannual \$41.50.

\$25 weekly will be available to members up to age 70. Principal sum, \$2,500; annual premium \$41, semiannual \$21.

Full benefits received at the time of purchase are available up to age 70 or time of retirement, regardless of age or plan at date of purchase.

To meet requests for increased hospitalization coverage, members under age 60 who are participating in the plan may have optional hospital coverage to the following extent:

\$7 in cash for each day of hospital confinement, up to 70 days per disability, for room and board.

Up to \$35 for X-ray examination, anesthetics, laboratory, operating room, drugs, dressings and other necessary miscellaneous hospital expense, and for ambulance service to and from the hospital.

Up to \$225 for surgical operations, according to the schedule.

The additional premium for this optional hospital plan is \$20 annually and \$10 semiannually. This type of coverage, available only to members insured under the ASCE Group Disability Plan, is offered in the overall plan.

Since the benefits from the ASCE optional hospital coverage will be paid to the insured in cash, they can be used to defray hospital or any other expenses incurred through disability. The ASCE hospital benefits are payable in any hospital in the world, regardless of other insurance carried.

"Civil Engineering" Is Available in Microfilm

Members are reminded that the Society has an agreement with University Microfilms, of Ann Arbor, Mich., which makes CIVIL ENGINEERING available to libraries in microfilm form. Solving the problem of providing space for the large number of publications received by libraries, microfilm makes it possible to produce and distribute an entire volume of a periodical in a single roll, in editions of 30 or more, at a cost about equal to that of binding the same material in a conventional library binding.

Under the microfilm plan, libraries keep paper copies unbound until demand for them is over when they are disposed of and microfilm substituted. Sales are restricted to subscribers to the paper edition, and film copy is distributed only at the end of the volume year.

Inquiries concerning purchase of the microfilm, which is furnished in positive form on metal reels suitably labeled, should be addressed to University Microfilms, 313 N. First Street, Ann Arbor, Mich.

Ithaca Section Program Honors ASCE Centennial

An all-day program celebrating the Society's Centennial was conducted by the Ithaca Section on the Cornell University

campus before the close of the school year. The theme, "The Next Hundred Years," was developed by nine speakers from the faculty of the School of Civil Engineering. The speakers—N. A. Christensen, H. M. Gifft, D. F. Gunder, H. T. Jenkins, A. L. Jorissen, T. D. Lewis, A. J. McNair, R. Y. Thatcher, and George Winter—reviewed the highlights of the past and predicted the shape of things to come in the various fields of civil engineering.

S. C. Hollister, dean of the Cornell College of Engineering, and principal speaker at a noon luncheon, forecast the development of many new construction materials and prophesied radical advances in practical means for developing power from perpetual sources such as the sun. During the luncheon program a certificate of life membership in the Society was presented to Howard T. Ware, former Section president.

Student Chapter exhibits of work in the various fields of civil engineering, held over from the college's annual Engineer's Day, supplemented the program.

Puerto Rico Section Awards Student Prize

Prof. Franklin O. Rose, vice-president of Puerto Rico Section, presents to graduating senior Pedro Jimenez Quinones of University of Puerto Rico, medal awarded annually by Section to civil engineering student graduating with highest scholastic honors. Shown, left to right, are Prof. Virgilio Biaggi, master of ceremonies; Luis Stefani, vice-chancellor of university and dean of engineering; Mr. Jimenez; Professor Rose; and Prof. Miguel Wiewall, dean of science. Speaker of evening was Raoul C. Mitchell, visiting professor in civil engineering department at university, who discussed physical properties of the earth. Much of meeting was devoted to committee reports on plans for Inter-American Convention, which Section is sponsoring in San Juan in November.

Coming Events

Duluth—Meetings are held the third Monday of every month at the Kitchi-Gammi Club in Duluth.

Maine—Anniversary meeting will be held at the Worster Hotel, Hallowell, Me., on August 7.

Sacramento—Weekly luncheons every Tuesday at the Elks Temple, Sacramento, at 12 noon.

San Francisco—Weekly luncheons every Wednesday at the Engineers' Club of San Francisco.

INTER-AMERICAN CONVENTION

San Juan, Puerto Rico, November 12–15 1952

Scheduled ASCE Conventions

CENTENNIAL CONVOCATION
Conrad Hilton Hotel
Chicago, Ill., September 3–13, 1952

SAN FRANCISCO CONVENTION
San Francisco, Calif., March 2–7, 1953

MIAMI BEACH CONVENTION
June 17–19, 1953

News of Local Sections Briefed

SECTION	DATE	ATTENDANCE	PROGRAM
Akron	April 18	50	Dinner meeting and cocktail hour. Stanley Macomber, of Macomber, Inc., described recent developments in metal fabrication.
	May 22	...	Annual student meeting. Student papers read by John D. Jones and Charles J. Messmore, University of Akron.
Alaska Southeastern Subsection	May 27	18	Dinner meeting. A talk on "The Engineer's Unity Organization" was presented by G. J. Miller, and a film was shown.
Arizona	April 26	61	Annual spring meeting with Student Chapter, University of Arizona. Student award was presented to Dick E. Schramm. C. H. Handforth, R. H. Rupkey, and Percy Jones and W. Johannessen presented papers. Guest speakers were John C. Park, dean of engineering, University of Arizona, and James Macmillan, architect.
Buffalo	May 20	53	Wilbur S. Smith, partner, Smith, Dibble & Co., New Haven, Conn., spoke on the off-street parking survey of Buffalo.
Central Ohio	May 15	65	Joint meeting with Ohio State University Student Chapter. Brown scholarship prizes to Richard Bull, Simon W. Dudley and Earl Wagner. Other awards were presented to Raymond A. Grover, Trevor P. Craig, Leonard W. Fletcher and Patrick L. DeNaples. Archie M. Carter, head of the highway section, Associated General Contractors, was guest speaker.
Cincinnati	May 7	20	John Diehl, head of John Diehl Co., gave an illustrated talk on "Timber Covered Bridges."
Cleveland	May 16	82	Case Institute of Technology Student Chapter was host at the May meeting. Junior membership awards were presented to John E. Donahue, Freeman A. Ericson, Andrew G. Donovan and Sterling H. Booth. Dr. Henry F. Donner described his trip from Algiers to Capetown.

Georgia	June 6	52	Out-door supper and meeting at the home of Warren S. Mann, president of the section.
	May 19	...	Joint meeting with the Western Society of Engineers addressed by Harry S. Spitz, assistant chief engineer, U.S. Steel Company.
Illinois	May 23	...	Luncheon meeting. Certificates for Junior membership presented.
Iowa	May 26	25	Robert Galvanoni, field sanitarian, Rockford Department of Health, and Henry Reidesel, district engineer, Sanitary District of Rockford, discussed trends in garbage and sanitary waste disposal.
Ithaca	May 19	19	Dinner meeting. Junior membership prize awarded to Edward R. Bergun, Cornell University. Illustrated speech given by A. A. Tripp, Preload Company, Inc., New York City, on design and construction of prestressed concrete tanks.
Kansas City	May 6	114	Guest speaker Samuel B. Morris, general manager and chief engineer of the Los Angeles Department of Water and Light, discussed the national water policy, at a dinner meeting. William D. Swanson, of the University of Missouri, received a student award certificate.
	May 31	119	Picnic and dinner in honor of ASCE President Carlton S. Proctor and Mrs. Proctor.
Miami	May 1	77	Dinner meeting under auspices of Palm Beach Sub-Section. Col. Herbert C. Gee presented a speech on "Land and Water Conservation of Central and Southern Florida."
Nebraska	May 21	43	Dinner meeting followed by tour of the Nebraska Department of Roads and Irrigation Testing Laboratory.
Northwestern	May 5	75	Student prizes awarded at dinner meeting. Discussion of the Pick-Sloan plan for development of the Missouri River Basin given by Leslie Miller, former Governor of Wyoming.
Pittsburgh	May 24	42	Tour of the new building of the Aluminum Company of America, and luncheon meeting.
St. Louis	May 26	90	Irvin Mattick, information supervisor, Southwestern Bell Telephone Co., spoke on "Midgets of the Telephone Science."
	June 4	130	ASCE President Carlton S. Proctor, Vice-President D. V. Terrell and Director Norman R. Moore were present at a special meeting, at which Colonel Proctor discussed the Centennial celebration.
Syracuse	April 25	42	Newly elected officers for next year are: James E. Blowers, president; George P. Hanna, Jr., first vice-president; Clyde A. Coats, second vice-president; Alfred J. DeYoung, director; and Charles M. Antoni, secretary-treasurer. Dr. Otto Holden, director of ASCE, described Canadian plans for developing additional power from Niagara Falls.
Tri-City	May 13	46	Joint meeting with the Muscatine Engineers Club. Life membership certificates awarded to Charles H. Young, and Jesse McShane. Art Ladehoff of the Clinton Engineering Co., presented an illustrated talk.

ASCE President Carlton S. Proctor (center) is met at Phoenix Airport by J. A. Rau (right), president of Arizona Section, and Elmer J. Maggi, publicity chairman, as he arrives for talk at large Section dinner meeting. In discussion of Centennial of Engineering objectives, Mr. Proctor warned profession of evils of complacency and urged increased participation in public affairs.

New Highway Division Contact Is Appointed

As noted in the May issue (page 67), the ASCE Highway Division has appointed contact men in each Local Section located near the headquarters of a state highway department to promote cooperation with the various highway departments. To the list appearing in that issue, the Division has now added the name of a contact man for Ohio: Fred E. Swineford, Macadam Pavements, Inc., 17 South High Street, Columbus, Ohio.

Guide from Lehigh Structural Steel Co. explains fabricating process to some members of Junior Branch of Metropolitan Section. Recent field trip, sponsored by Junior Branch in cooperation with American Institute of Steel Construction, took 150 of Section's Juniors to Pennsylvania to view production, rolling, and fabrication of structural steel. Trip included guided tour through Bethlehem Steel Co. plant at Bethlehem, Pa., where all operations from coke ovens to rolled sections were viewed. Bolted, riveted, and welded fabrication shops of the Lehigh Structural Steel Co., in Allentown, Pa., were also visited.

NEWS BRIEFS . . .

Record Construction Outlay for 1952 Foreseen

Outlays for new construction in 1952 are expected to amount to more than $32 billion, setting a new record, according to a recent joint forecast made by the Building Materials Division of the Department of Commerce and the Labor Department's Bureau of Labor Statistics. This will represent an increase of about $1 billion over the revised 1951 total, reflecting largely increased expenditures for military and atomic energy facilities. Although the expected private investment of over $21 billion will vary only slightly from last year's total, public outlays of nearly $11 billion are expected—an increase of $1.6 billion (17 percent) over 1951.

Recent partial relaxation of Regulation X is expected to have an important effect on the anticipated volume of new construction for 1952. Adequate supplies of all nonmetallic building materials, as well as adequate supplies of construction labor in most localities, are expected.

Allotments of steel for the third quarter were eased from previous quarters, a factor that added to the booming of the construction market. The steel strike, which has cut production to 12 percent of capacity, will probably reverse this trend. The American Iron and Steel Institute reports the loss of nearly 5.5 million tons of steel in late April, early May, and the first two weeks of June as a result of the strike. The total will be increased by approximately 262,000 tons each day that the strike continues, according to the Institute.

Although a sharp decline in expenditures for commercial and religious buildings is looked for as a result of restrictions affecting these types of construction during the first half of 1952, more liberal allotments of controlled materials for such projects beginning in the third quarter will permit some recovery toward the end of the year. The joint agencies look for the expenditure of more money by public utilities for new construction in 1952, particularly for electric power and telephone facilities and petroleum pipelines. With the rounding out of the industrial expansion program begun last year, a slight increase in expenditures for private industrial plants over 1951 is expected.

Public spending for atomic energy and defense plant construction is expected to exceed $1.6 billion in 1952, representing an increase of about 70 percent over 1951 outlays for such purposes. Expenditures for military installations will probably amount to $1.9 billion, an increase of about 85 percent.

An anticipated increase in expenditures for public housing represents work started on an estimated 50,000 new public housing units this year, when many projects planned under the Housing Act of 1949 finally got under way. The joint agencies forecast only small increases in school and highway construction and look for a decline in volume of most other types of public works, including hospitals, public buildings, and reclamation work.

New Zealand Builds Four-Berth Ocean-Freight Terminal

Current status of work on four-berth import wharf being built at Auckland, N. Z., is shown in this recent air view. Of earthquake-proof design, supported by reinforced concrete piling, the 1,200 by 300-ft pier is first major pier construction project undertaken at Auckland since 1939. About one-third of the 3,363 reinforced concrete piles have been driven to date. A project of the Auckland Harbor Board, the pier is being built jointly by two American and one New Zealand construction companies—the Raymond Concrete Pile Co. and Merritt-Chapman & Scott Corp., both of New York, and the Fletcher Construction Co., Ltd., of Auckland.

Third Lincoln Tube Under Hudson Approved

Plans for construction of a third tube in the Lincoln Tunnel under the Hudson River at West 40th Street, originally proposed by the Port of New York Authority in March 1951, can now be carried out, following recent settlement of a disagreement between the Port Authority and city officials over construction of the Manhattan approaches. Construction can start, Mayor Impellitteri has announced, as soon as the Board of Estimate approves an agreement by the Port Authority to build additional connections to the tunnel when traffic conditions warrant.

City approval of the proposed five-year, $85,000,000 project was originally withheld on the ground that projected connections with Manhattan streets were inadequate. When traffic reaches 30,000,000 vehicles a year through the expanded tunnel, the Port Authority has agreed to build a set of four-way ramps to and from the West Side Highway and 30th Street, and to widen 30th Street between Tenth and Twelfth Avenues. It was originally estimated that yearly traffic would reach 26,000,000 vehicles by the time the third tube was in use.

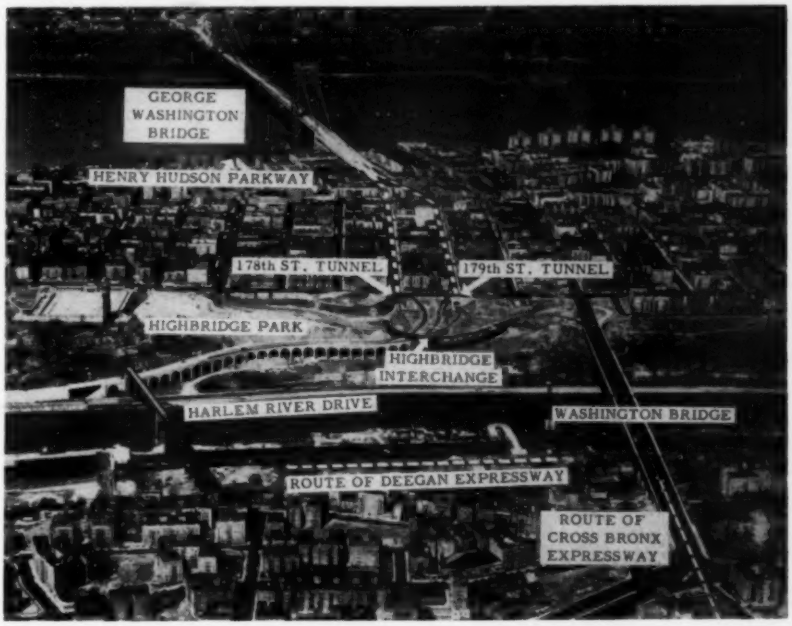
The first tube of the Lincoln Tunnel was opened to traffic in December 1937, and the second in February 1945. It is expected that the third tube will increase the capacity of the tunnel by 8,500,000 vehicles a year. Since the opening of the New Jersey Turnpike early this year, there has been a tremendous increase in tunnel traffic, with many serious traffic jams.

Hunts Point Treatment Plant Begins Operation

The Hunts Point Pollution Control Plant, ninth major unit in New York City's program to clean up its recreational waters by the end of 1953, was put in operation on June 20 in ceremonies conducted by Mayor Impellitteri. Built at a cost of $22,258,000, which includes necessary intercepting sewers, the new Hunts Point sewage treatment project will serve the central and eastern sections of The Bronx—an area larger than Manhattan. Treatment of the waste from this area, which was formerly discharged into the upper East River, will eliminate pollution not only along the Bronx shore from Eastchester Bay to 149th Street but also along the north shore of Queens.

Treatment provided by the Hunts Point Plant, called "the step aeration modification of the activated sludge process," permits aeration in smaller and less costly tanks and results in substantial savings to the city. Currently treating 120 mgd from a population of 770,000, the plant has a capacity of 160 mgd from an ultimate population of 961,000. The project was designed and built under supervision of the Department of Public Works, of which Frederick H. Zurmuhlen, M. ASCE, is director.

Tunnel and Interchange to Speed New York Traffic



Recent opening of tunnel and interchange in upper Manhattan completes cooperative project of city and state designed to expedite traffic, increase traffic safety, and reduce street congestion. Project, indicated on this aerial view, consists of $9,000,000 West 179th Street Tunnel built by Port of New York Authority for westbound traffic from Highbridge Park to George Washington Bridge, and $5,300,000 Harlem River Drive and Cross Bronx Expressway Traffic Interchange built by state under supervision of New York Department of Public Works. Begun in March 1949, project constitutes important link in vast network of vital metropolitan arteries. Speakers at opening ceremonies included Mayor Vincent Impellitteri; Bertram D. Tallamy, A. M. ASCE, superintendent of New York State Department of Public Works; and Howard S. Cullman, chairman of Port Authority.

Load Effect on Bituminous Pavements to Be Tested

Rigorous road tests are about to begin on a recently relocated section of U.S. Route 191 between Pocatello, Idaho, and Ogden, Utah, just north of the Idaho-Utah boundary. Similar to Road Test One-MD made in Maryland in 1950 and 1951 to ascertain the effects of four different axle loads on concrete pavement, the new tests will determine relative effects of four different axle loads upon bituminous pavement. The project, known as the WASHO Road Test, is being sponsored by the highway departments of a group of Western States, the Bureau of Public Roads, and vehicle manufacturers.

Built in a valley on uniform silt subgrade, the highway test section consists of two pairs of 1,900-ft tangents connected by elevated turnarounds. Five different thicknesses of flexible-type pavement will be tested in each of the tangents for 18,000- and 22,400-lb single-axle loads and 32,000- and 40,000-lb tandem-axle loads. Tests will be conducted as late as possible this summer and resumed in 1953 until a total of six months of operation has been completed.

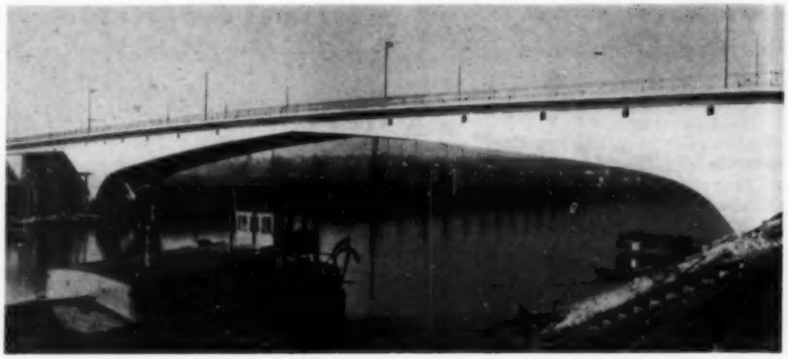
Final reports on Road Test One-MD may be obtained from the Highway Research Board, which conducted the concrete road tests for the Bureau of Public Roads and other agencies. Inquiries should be addressed to the Board, 2101 Constitution Avenue, Washington 25, D.C.

Urban Problems Studied at Businessmen's Conference

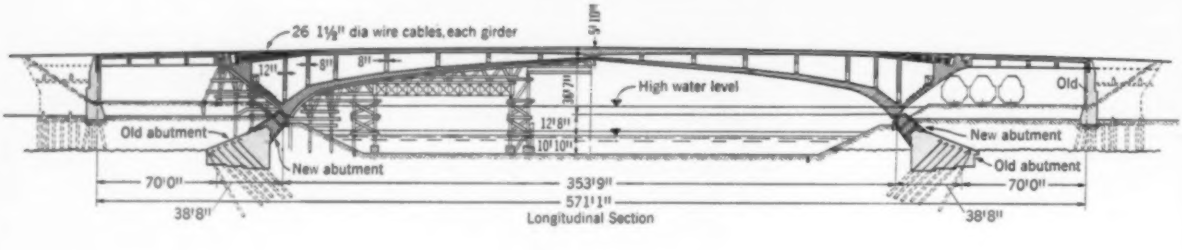
All phases of urban engineering were explored at a two-day Conference on Urban Problems held in Portland, Oreg., June 23 and 24. The fourth in a series of annual conferences on urban problems sponsored by the Chamber of Commerce of the United States, the program brought together engineers, traffic experts and administrators from all over the country. Subjects of discussion ranged from city traffic with the allied problem of parking to rehabilitation of blighted areas.

The relationship between urban redevelopment and the city plan was outlined in papers by Max S. Wehrly, director of the Urban Land Institute, Washington, D.C.; William B. Randall, chairman of the Housing and Redevelopment Authority, St. Paul, Minn.; and Nathaniel S. Keith, director of slum clearance and urban redevelopment, Housing and Home Finance Agency, Washington, D.C. Alan E. Brockbank, president of the National Association of Home Builders, Salt Lake City, Utah, told the group that it is possible to have cities without slums. "The formation of slums can be stopped," he said, "and blighted areas rehabilitated by the use of one weapon—enforcement of existing laws regulating health, building standards, safety and sanitation." A pattern of slum clearance, developed in Baltimore and known as the Baltimore Plan, was advocated by Mr. Brockbank. The plan has been successfully adopted by other cities, including Charlotte, N.C., and Pasadena, Calif., he said.

Sessions on "Streamlining Urban Traffic" and "Off-Street Parking" featured talks by Henry A. Barnes, director of the Traffic Engineering Division of the City and County of Denver; Thomas E. Willier, director of the Houston, Tex., Department of Traffic and Transportation; D. Grant Mickle, M. ASCE, director of the Traffic Engineering Division of the Automotive Safety Foundation, Washington, D.C.; and Lyman E. Wakefield, president of Downtown Auto Park, Inc., Minneapolis, Minn.



Prestressed concrete bridge at Heilbronn over harbor canal has 353-ft span. Each half of three-hinged structure consists of two hollow box-girders, prestressed with thirteen $1^1/_2$-in. spiral wire cables.



Prestressed Concrete Bridge at Heilbronn, Germany, Has 353-Ft Span

An outstanding bridge, said to be the longest-span prestressed concrete bridge in the world, is the harbor canal span at Heilbronn in South Germany. It connects two districts of the town and will be an important link in the Nürnberg-Heilbronn-Heidelberg Highway. A three-hinged reinforced concrete frame structure, erected in 1931–1932, was blown up by the German troops in 1945.

The new bridge, shown in Fig. 1, is designed as a three-hinged reinforced-concrete frame of 353-ft 9-in. span. The huge arched frame has 38-ft 8-in. cantilever arms at both ends, which in turn support one end of 70-ft spans over the harbor tracks and roadways. The total length of the bridge is 571 ft 1 in. The total width of 49 ft 2 in. includes two sidewalks, each 5 ft 9 in. wide. This width consists of two 13-ft 1-in.-wide hollow box-girders, with cantilevered sidewalks, and a simple-span slab between the girders in the middle which carries a car track. The vertical dead load on supports amounts to 3,960 tons, the live load 540 tons. The horizontal dead load at supports is 4,070 tons and 1,320 tons from live load.

The stiffening cross walls in the hollow box-girder are 8 in. thick and are spaced 29 ft 6 in. apart. A special cross-wall is provided at the break of the flat-frame corner in order to resist the upward pressure component resulting from the bottom plate of the girder at this point. The cross-walls over the supports are 10 in. thick in order to transmit horizontal wind forces to the supports. The old abutments were raised and widened to fit the new bridge structure.

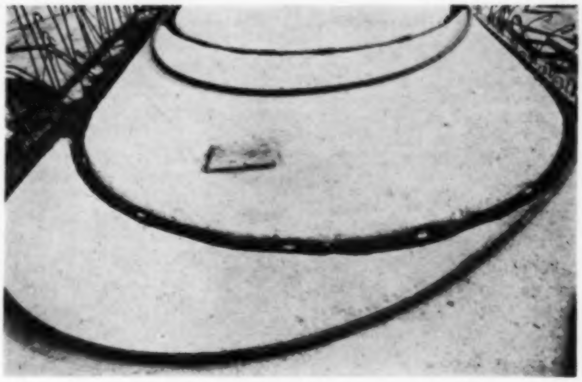
The high tensile forces in the top of the hollow box-girder frames over the supports called for prestressed construction. Spiral wire cables, fabricated by the Felten & Guilleaume Co., at Cologne-Muelheim, were used. Each half of the arch-frame box girders was prestressed with 13-wire cables, each $1^1/_2$ in. in dia. Each cable consists of 62 wires 0.16 in. in dia, treated in a special lead bath. The cables are laid in a trough

Safety Conference Calls for Redoubled Action

Additional efforts must be made to combat work accidents in order to conserve manpower for defense production, President Truman told 1,500 delegates attending the President's Conference on Industrial Safety, held in Washington, D.C., June 2–4, under sponsorship of the Department of Labor. Pointing out that the defense program has brought thousands of new workers into defense plants and other industries, with a resultant 9 percent rise in accident rates, the President suggested an eight-point action program to reduce industrial accidents. The proposed program includes better accident reporting and analysis; a more careful check on machinery; safety education in schools, colleges, and plants; a safety organization in every company; greater worker participation in safety programs; and increased uniformity and modernization of state safety codes.

Training tomorrow's engineers for safety was discussed by S. S. Steinberg, M. ASCE, dean of the College of Engineering at the University of Maryland, and W. N. Cox, Jr., head of the department of safety engineering at the Georgia Institute of Technology. Dean Steinberg received a special Department of Labor award of merit for his work as chairman of the Conference Committee on Education.

Statistics on the industrial safety situation in 1951 recently made available by the National Safety Council disclose that the communications industry again maintained the lowest employee accident rate, and that the electrical equipment industry ranked second followed by the cement industry. The construction field showed an increase of 8 percent in accident frequency rate from 1951 but a drop of 10 percent in accident severity rate.



As tensile stress in top of girders decreased from support to center hinge, cables were turned back to end of girder in semicircular trough. Inside wall of trough is armored to protect surface. Dowels take up shear load. Freyssinet-type anchorages at shore end of girders take prestress load.

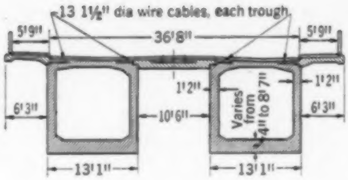


Fig. 1 (left). Arch rib forms for Heilbronn bridge are supported on long-span falsework to permit uninterrupted passage of canal traffic during construction. Stiffening cross walls in hollow box-girder (shown in cross section at right) are 8 in. thick and spaced 29 ft 6 in. apart.

This material is translated and abstracted by Remig A. Papp from two articles by Willy Stöhr, Board of Substructures, in the German periodical, "Beton- und Stahlbetonbau," No. 12, 1950, and No. 2, 1951.

formed into the top slab of the box girder. The ultimate strength of the wires is 240,000 psi and of the cable itself 228,000 psi, and the actual tensile stress in the cables amounts to about 55 percent of the ultimate strength. The cables were post-tensioned after the last pour of concrete was 30 days old. After post-tensioning, the cable troughs were filled with concrete.

Since the tension increases from the central hinge towards the supports, it was not necessary that all the cables run through the total length of the half-girder frame. The cables end in semicircular troughs spaced along the top of the girders. The interior wall of each trough is armored to protect the concrete surface during post-tensioning. Shear in the concrete itself was taken by dowels. The average length of the cables is 111 ft and the computed elongation at this length was 8 in. Shrinkage and creep of the concrete, as well as the creep of the steel wires, were also taken into consideration and computed.

The total tensile force exerted by 52 cables amounted to 3,300 tons. The tensile stress in the cables amounts to 100,000 psi after deductions for shrinkage and creep. The webs or sidewalls of the box girder are 14 in. thick, increasing toward the top hinge to $27^1/_2$ in. The bottom slab is 4 in. thick near the top hinge, increasing to 8 ft 7 in. over the support. Because of these variable dimensions and the curved underside of the girder, the shear stresses were computed by graphical methods.

The Freyssinet-type anchorages of the cables are spread out in order to obtain the required support surface. The concrete behind the anchorage contains 7.2 bags of high-strength cement per cubic yard. To transmit the anchorage forces into the lower parts of the concrete, several provisions were necessary, of which the most important was an efficient shear reinforcing consisting of bent-down bars and stirrups that are vertical along the larger portion of the frame length and inclined near the support.

The falsework supporting the forms for the box-girder frames consisted of three long spans in order to permit uninterrupted navigation during construction. The forms were decentered partly by hydraulic jacks and partly with sand pots. The superelevation at the middle point of the structure was computed as 10 in., made up of 2.2 in. caused by dead-weight load, 3 in. by creep, 2 in. by shrinkage and 2.8 in. by compression of the upper and lower part of the falsework. The same falsework was used for both girders in each span.

The concrete tested 5,100 to 5,700 psi in compression after 28 days, using a compound called Plastiment. The actual maximum compressive working stress amounts to 1,350 psi.

The bridge was finished in December 1949. After a winter pause and minor finishing work, the loading tests were made. The test load amounted to 686 tons consisting of 9 tramway cars, 5 steam rollers and 28 trucks. The measured deflection, amounting to less than half an inch, agreed exactly with the computed deflection. The bridge was opened to traffic in May 1950.

The prestressed construction showed a steel saving of 40 percent and a concrete saving of 16 percent over the old reinforced concrete structure it replaced even though the new bridge is wider than the old one.

Wayss & Freytag A.G., of Frankfort-Main, designed and constructed the bridge. Difficult problems arising in design and construction were handled by the late Prof. Dr. Ing. Moersch of Stuttgart, an outstanding exponent of the theory and application of reinforced concrete, who died in 1951.

Harlan County Dam in Nebraska Is Dedicated

Dedication of the Harlan County Dam and reservoir on the Republican River in south-central Nebraska took place on June 10. A unit in the Pick-Sloan plan for coordinated conservation and development of the Missouri River Basin, the $49,000,000 multiple-purpose project was built under the immediate supervision of the Kansas City District of the Corps of Engineers with the cooperation of the Bureau of Reclamation and county agencies. Its total length of 11,830 ft includes 10,480 ft of compacted earth-fill embankment and 1,350 ft of concrete spillway and bulkhead structure. Construction was begun in 1946, and completion of all major phases of the dam and reservoir by 1953 is expected.

Although flood control will be the dominant function of the project, it will also furnish water for irrigating 29,000 acres in Nebraska and 62,000 acres in Kansas and will have incidental recreational and wild life conservation benefits. Operation of the project for irrigation will be in accordance with an agreement between the Corps of Engineers and the Bureau of Reclamation.

New Laboratories for Bureau of Standards

Construction of a new building to house the National Bureau of Standards laboratories at Boulder, Colo., will be started soon, following award of a contract to the Mead & Mount Construction Co., of Denver, low base bidder at $3,123,000. The new building, scheduled for completion by February 1954, will provide complete modern facilities for a research staff of about 500, to be transferred from the Washington headquarters of the Bureau.

Well Points Unwater 25 Acres at Shawnee Steam Plant

Rapid progress is being made in construction of huge Shawnee Steam Plant being built for Atomic Energy Commission near Paducah, Ky. Engineering and construction are under direction of Tennessee Valley Authority, with Fred L. Weiss, A. M. ASCE, project manager. Nearly 70,000 cu yd have been excavated from 25-acre plant site, most of it to depths of more than 70 ft. Two stages of well points, installed around substructure by John W. Stang Corp., in February 1951, have kept water table below subgrade in working area. Pumping has averaged 6,000 gpm in well-point system designed to handle peak loads of 17,000 gpm. This $88,000,000 steam plant, designed for ultimate capacity of 1,500,000 kw, will furnish part of power for AEC atomic energy plant being built at Paducah.

Inadequate Water Resources in Youngstown Area Reported

Shortage of water for individual use, gross pollution of existing supplies, high river-water temperatures, and danger of floods present serious problems in the Mahoning River Valley, according to a recent report of the U. S. Geological Survey. The fourth largest steel center in the world, the Youngstown area is highly industrialized and has a population of almost a third of a million.

The report notes a tremendous increase in the industrial use of water with expanding productive effort. The 1949 water demand (including recirculation in the industrial area) has been estimated at 1,270 mgd, of which 1,200 mgd is taken from the streams and used by industry without treatment and 62 mgd is taken from the streams for public supplies. This is more than twice the average annual flow and about fourteen times the minimum daily flow of the Mahoning River that has occurred since 1944 when the last of the four reservoirs in the basin was placed in operation. Industry uses 7 mgd of ground water, and public supplies 1.5 mgd. The report concludes that, although low water regulation by existing reservoirs has greatly improved flow conditions, additional storage will be required to prevent possible critical water shortages. Geological conditions are held unfavorable for large ground water yield in the Mahoning River Basin. A diversion project in the Grand River Basin as a possible source is under study by the Corps of Engineers.

Copies of the report, which is being issued as USGS Circular 177, are available without charge from the Director of the Survey, Washington 25, D.C.

Army Completes Emergency Design Construction Program

Completion of a two-year Army Corps of Engineers program to provide new designs for emergency-type military construction is announced by the Department of Defense. The designs, which cover 245 different types of buildings, will be used in the event of an emergency requiring expeditious and economical construction. Buildings are designed for a life expectancy of from three to five years, and the designs are prepared for three zones of temperature.

Basically, the buildings are constructed on a concrete slab on grade, which eliminates expensive wood floor framing and permits the use of mass construction methods. The building width is 25 ft, determined to be the most economical framing, and the walls are 8 ft high. Wall studs are placed to receive a standard 4 by 8-ft wall. The design permits use of various types of wall coverings, and a simple horizontal sliding window has been substituted for more costly double hung windows. Masonry wall construction is utilized only in rooms containing utilities. Rolled roofing or built-up roofs are used for roof covering.

Material on Construction of Radioactive Labs Issued

To meet the increasing need of architects, engineers, and manufacturers for practical information on the design of structures to house the many phases of atomic energy work, the Building Research Advisory Board is making available the proceedings of its recent two-day conference on "Laboratory Design for Handling Radioactive Materials." The conference, which was conducted by the Building Research Advisory Board with joint sponsorship of the American Institute of Architects and the Atomic Energy Commission, took an important step toward acquainting the profession with the specialized problems created by the rapid expansion of radio isotope usage for agricultural, industrial and medical purposes and the resulting need for establishing design criteria for such buildings.

Issued as BRAB Conference Report No. 3, the proceedings may be obtained from the Building Research Advisory Board, National Research Council, Washington, D.C., at $4.50 a copy. Quantity prices will be quoted on request.

San Francisco Completes Sewage Treatment Plant

With completion of a new 150-mgd sewage treatment plant, the heavily developed North Point region of San Francisco now has treatment facilities adequate for an estimated 1960 population of 835,000. The new plant is unique in that it does not treat the sludge itself. Sludge is pumped through a 10-in. pipeline to a separate treatment plant six miles away, where it is washed, filtered, chemically treated, and dried to produce soil conditioner at the rate of about 150 tons a week. Though operations are carried on in ten different buildings, special control equipment, supplied by the General Electric Company, permits centralized direction of the processes.

The North Point installation completes a long-range program to improve the San Francisco waterfront and eliminate pollution of its beaches.

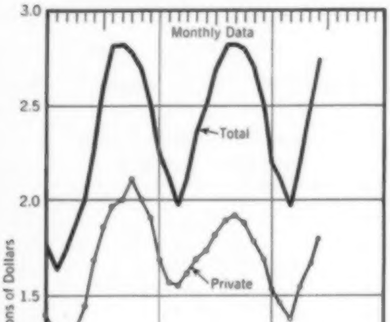
New Record for Construction Activity Is Reached in May

Expenditures for new construction rose to \$2.75 billion in May 1952, setting a new record for the month, the U. S. Labor Department's Bureau of Labor Statistics and the Building Materials Division of the Department of Commerce jointly report. During the first five months of the year, total new construction outlays amounted to \$11.9 billion, an increase of 3 percent over the total for the corresponding period of last year.

Seasonal advances in most types of construction this May maintained construction activity at a level moderately above a year ago. Expenditures for private residential building were about the same as in May 1951, and factory building was still substantially above last year despite recent declines. Most other types of private nonresidential building activity were below year-ago levels. Public utility construction showed a moderate increase over the year. With total private outlays for new construction amounting to \$1.8 billion in May, expenditures for the first five months of 1952 came to \$8.1 billion.

Public spending for new construction continued its upward climb during the month, reaching \$947 million in May. An increase in highway work, although less than usual for the time of year, was an important factor in boosting the public construction total. Federal expenditures for military, atomic energy, and defense plant facilities rose more than seasonally. Total public outlays for new construction during the first five months of the year exceeded \$3.8 billion, an increase of 25 percent over the corresponding period of 1951.

NEW CONSTRUCTION ACTIVITY



Construction expenditures in May set new record for month. Department of Commerce curves for first five months of year show 3 percent increase over corresponding period last year.

N. G. Neare's COLUMN

R. Robinson Rowe, M. ASCE

"I'm curious, Joe," admitted Professor Neare. "How many hours did you spend on the triangular garden fence?"

"Not quite one," bragged Joe Kerr.

"'At 'a boy. Essentially I asked for the perimeter necessary to a triangle inscribed in a larger one with sides of 175, 210 and 245 ft, didn't I? How long, Joe?"

"I didn't work it out, Professor. I just proved to my satisfaction that it was an all-night problem; then I turned in. I call that smart. I lettered the given triangle ABC and the unknown triangle DEF. Using x, y and z for distances AD, BE and DF, I wrote a complicated expression for L, the perimeter of DEF. Now to make L a minimum, I knew I had to equate to zero the partial derivatives of L with respect to x, y and z, then solve these 3 simultaneous equations, which would take all night."

"Let me ask you, Joe, could you locate F if I told you where D and E were?"

"Sure. The shortest path DF-FE would be the reflection path, with equal angles of incidence and reflection."

"Now what about D and E? Think hard, Joe."

"Why, they'd have to be reflection points, too. I never thot of that."

"Until just now, you mean. If I'd given you a triangular billiard table and asked you to find a continuous-carom path, I'll bet you'd have had the answer in a jiffy. Now Cal Klater hasn't any triangular billiard table, so I'll bet he used a table of squares."

"In a way, yes," answered Cal. "First I proved there was only one continuous-carom path, then that triangles AFD, BED, EBD and EFC were each similar to ABC, then that D, E and F were pedal points (feet of perpendiculars from opposite vertices), and finally that $L = 8A^2/abc$, where A is the area of the triangle. With the given data, this general formula gives L = 288 ft, and I couldn't help but notice that all intercepted distances are integers."

"An easy set-up, Cal. If the given sides are rational, so are all these distances; using the least common denominator for a scale ratio clears all fractions.

"If you didn't see it yourself, you'll be interested in the Independence Day parade at Numeropolis. It started with a column of 6 phalanges, each phalanx a solid square; no two were alike, the smallest being in the van and the largest in the rear. At the command 'Phalanges Ho,' the first, third and fifth each marked time while the following phalanx surrounded it, after which the column advanced in 3 squares. At the command 'Phalanges Ho Ho', the fourth phalanx peeled off of the third and surrounded the rear square while the third surrounded the leading square, after which the column advanced in 2 squares. Finally at 'Phalanges Ho Ho Ho', all joined in one great square to pass in review. How many phalangites must there have been?"

[*Cal Klaters were: Richard Jenney, John L. (Stoop) Nagle, Flo Ridan (Charles G. Edson), Thomas J. Ogburn III, Marvin (Sauer Doe) Larson, and Julian Hinds.*]

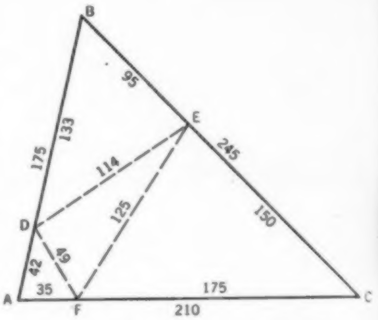


FIG. 1. Fencing off garden DEF with minimum perimeter isclates three triangles similar to ABC.

Fellowships in Housing Available in Colombia

The recently established Inter-American Housing and Training Center, with headquarters in Bogota, Colombia, is making available 21 one-year fellowships for graduate study in the technical, economic, and social aspects of low-cost housing. Research into financing, administration, effective utilization of local building materials, construction methods, site planning and design will be an important function of the center, which was established in May under the technical cooperation program of the Organization of American States. The United States is one of the 21 American Republics having membership in the Organization of American States.

Inquiries concerning the fellowship project should be addressed to the Division of Housing and Planning of the Pan-American Union, Washington 6, D. C.

NEW ALLIS-CHALMERS HD-9, HD-15 ARE

built to GET MORE DONE

built to TAKE IT LONGER

UNEQUALLED LUGABILITY

The HD-9 and HD-15 build up greater drawbar pull faster . . . hold it longer than ever thought possible in gear transmission tractors.

For example, when tough going has pulled travel speed down 40 percent, these tractors will have increased their drawbar pull almost 20 percent over rated pull. They will lug down almost 45 percent from rated travel speed before drawbar pull even starts to fall off.

To take full advantage of this important GM 2-cycle diesel engine characteristic, the HD-9 and HD-15 have longer truck frames, lower idlers and sprockets. That means more track on the ground . . . better stability . . . sure-footed traction . . . unequalled *lugability*.

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Here are a few of the many reasons why these newest, finest tractors are *built to take it*.

- **All-Steel Welded Construction**
- **More Power with Bigger Engines — Longer Engine Life**
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- **Long-Lasting, Large Diameter Clutches**
- **Double Reduction, Straddle-Mounted Final Drive Gears with Live Sprocket Shafts and Caged Bearings**
- **Positive Operating Track Release — Works in Oil**
- **All New, Specially Designed Track Assembly**
- **Positive-Seal Truck Wheels, Support Rollers and Idlers; Mounted on Tapered Roller Bearings, 1,000-Hour Lubrication!**

Your Allis-Chalmers dealer will be glad to explain all of these advantages. See him or phone him now.

THE NEWEST, FINEST LINE ON EARTH!

HD-5
40 drawbar hp.
11,250 lb.

HD-9
72 drawbar hp.
18,800 lb.

HD-15
109 drawbar hp.
27,850 lb.

HD-20
Hydraulic Torque Converter Drive
175 net engine hp.
41,000 lb.

ALLIS-CHALMERS

TRACTOR DIVISION — MILWAUKEE 1, U. S. A.

DECEASED

Sanford W. Sawin, Former Director, Dies

Sanford Wales Sawin (M. '30) of Hockessin, Del., died on May 17 at the age of 70. Long active in the Society, Mr. Sawin was a former Director (1939–1941) and a past-president of the Philadelphia Section. For 32 years, Mr. Sawin served in the engineering department of the du Pont Co., which he joined in 1915. He served the company in Calama, Chile, as assistant superintendent of construction at a dynamite plant, as superintendent of construction of a plastics plant at Arlington, N.J., and as project engineer in the design division at Wilmington. He was appointed supervising engineer on the designing of explosives plants for the government in June 1940 and in October 1944 became supervising and principal engineer of the design division. On retiring from the du Pont Co. in 1947, he went to Richland, Wash., as a consultant for General Electric. Mr. Sawin was an alumnus of the University of Delaware.

Sanford W. Sawin

David Maurice Berry (A.M. '40) associate bridge engineer in the Bridge Department of the California Division of Highways at Sacramento, died there on May 8. He was 45 years old. At the outset of his career, Mr. Berry served as an architectural draftsman for several California architects and firms. His association with the California Division of Highways began in 1929 when he entered the Department of Public Works as a junior engineering field aid. Mr. Berry served in the U.S. Navy during World War II, for three years. He was active in the Sacramento Section.

Frank Harvey Hefner (M. '49) district engineer, Illinois State Division of Highways, Edwardsville, Ill., died on February 1, at the age of 59. He received a degree in civil engineering from the University of Missouri in 1921, and since then had been continuously connected with the Illinois Division of Highways. Mr. Hefner joined the staff as a junior engineer, and held the position of resident engineer, traffic engineer, and district maintenance engineer.

Charles Sumner Duke (M. '49) construction engineer, U.S. General Services Administration, Construction Division, Cuban Nickel Plant, at Oriente, Cuba, died in Chicago, Ill., on June 11. He was 73. Mr. Duke was employed as an engineer for Geo. W. Jackson, Inc., Chicago; as a draftsman for the Commonwealth Edison Co., Chicago; and the Engineering Bureau, City of Chicago; and as an engineer for the Sanitary District of Chicago. From 1922 to 1935, he was engaged in private practice in Chicago. Following that, Mr. Duke was connected with the Federal Public Housing Authority at Washington, D.C., for a brief period, and until last year was civil and construction engineer with the Federal Works Agency on the Public Works Program for the Virgin Islands. He was an alumnus of Harvard University and did graduate work at the University of Wisconsin.

Llewellyn Nathaniel Edwards (M. '16) retired bridge engineer, died in Washington, D.C., on May 13, at the age of 78. After graduation from the University of Maine, he worked for the Boston Bridge Works, the City of Toronto, Canada, and several railroads. Following World War I, in which he served as a captain of engineers, Mr. Edwards entered the Bureau of Public Roads in charge of bridge construction in Arkansas, Louisiana, Oklahoma and Texas. In 1920 he was appointed bridge engineer for the State of Maine and held this position for eight years. He then returned to the Bureau of Public Roads in the capacity of structural engineer, where he remained until his retirement in 1944.

John North Edy (M. '19) well-known municipal engineer, and president and general manager of the Industrial Road Equipment Corp., Houston, Tex., died in that city on May 10. He was 67 years old. Mr. Edy went to Houston in 1943 to serve as its first city manager, after holding similar positions in other cities in Texas, Ohio, Michigan and California. In 1945, he resigned to enter private business. Mr. Edy held degrees in civil engineering from the University of Missouri, a master of arts degree from the University of California, and also studied at Stanford University for two years.

Lewis Nebinger Fisher (A.M. '20) president of Fisher-Stoune, Inc., Decatur, Ill., died there on April 25, at the age of 61. Widely known in the Midwest as a structural engineer and builder, Mr. Fisher was a partner in the general contracting firm of Cope and Fisher in Decatur for many years, and more recently served as the head of Fisher-Stoune, Inc., also of Decatur. During World War I, he was a first lieutenant in the Field Artillery, U.S. Army. He was an alumnus of the University of Illinois.

Clyde Charles Kennedy (M. '20) consulting engineer of San Francisco, died on April 26 at the age of 71. For the past 35 years, Mr. Kennedy headed his own engineering firm in San Francisco, and was connected with sanitary installations throughout the West. Prior to that he served as assistant engineer and city engineer at Berkeley, Calif., for seven years; as an assistant engineer on the Pennsylvania Railroad; and as associate editor of *Western Construction News*. Mr. Kennedy received degrees from Earlham College and the University of Illinois.

Harry Otto Garman (M. '21) retired consulting engineer of Indianapolis, Ind., died there on May 9. He was 72. A graduate of Purdue University, he taught railroad engineering at his alma mater from 1902 to 1913, advancing from instructor to associate professor. Before entering private practice, he served as chief engineer of the Indiana Public Utilities Commission, from 1907 to 1921. Mr. Garman specialized in the appraisal of municipal utilities, and was the author of several reports on properties, utilities and industries.

Mandes Golder (M. '22) for over 20 years head of the Golder Construction Company of Philadelphia, Pa., died in that city on April 21, at the age of 67. Mr. Golder was connected with the Department of Water, Reading, Pa., as assistant engineer from 1907 to 1911. He joined the Department of City Transit, Philadelphia, as assistant engineer in 1913 and rose to division engineer, before his association with the Golder Construction Co. Mr. Golder was a graduate of the University of Pennsylvania.

Ezra Clark Garlow (M. '17) retired engineer of Alliance, Ohio, died in that city, on June 14, at the age of 83. Mr. Garlow was employed as a draftsman after receiving a degree in civil engineering from the University of West Virginia. From 1897 to 1913 he was associated with several bridge companies, including the Keystone Bridge Co., the American Bridge Co., the Riverside Bridge Co., and the Mt. Vernon Bridge Co. Mr. Garlow became connected with the Alliance Structural Company as chief engineer, when it was organized in 1914, and served as director until his retirement several years ago.

Oliver Perry Sarle (M. '01) retired engineer of Providence, R.I., died on May 10, at the age of 89. After graduating from Brown University, he established an engineering office with Edward W. Shedd, at Worcester, Mass. Later he became associated with other members of the Shedd family and was active in Providence, R.I., as a member of the firm, Shedd, Sarle & Shedd. Mr. Sarle served as engineer for the Rhode Island Commissioners of Shell Fisheries from 1891 to 1914; was connected with the R.I. Harbor Commission in various capacities from 1886 to 1939; and held several other public positions.

Robert Lewis Wing (A.M. '26) associate hydraulic engineer, Public Works Department, Division of Water Resources, at Sacramento, Calif., died at Indio, Calif., on April 30. He was 56 years old. After graduating from Stanford University, Mr. Wing worked as the Santa Clara County engineer and as an assistant engineer for the Southern Pacific Company before entering the state service. He was with the Division of Water Resources from 1924 until his death except for a brief interruption from 1928 to 1929, when he left to assist in a flood control plan for the Orange County Flood Control District. Recently he had been engaged in the planning phases of the California Water Plan. Mr. Wing was active in Society and professional affairs.

(*Continued on page 86*)

Arthur Allen Booth (M. '10) retired mining engineer of Los Angeles, died at his home in that city on December 9, 1951, at the age of 93. From 1884 until 1897, Mr. Booth was employed as location and bridge engineer on the construction of numerous railways in the Western states. Following that, he was U. S. mineral surveyor in Washington, Idaho and Montana, and engaged in private practice as a mining engineer with headquarters in Spokane, Wash. For 28 years, he was engineer in charge of overflow lands in Idaho for mine owners' associations. Prior to his retirement in 1921, he held the position of mining engineer and manager of the Gerties Mining Company of Spokane. In his youth, Mr. Booth was one of the original Pony Express messengers who rode between Fargo, Bismarck and St. Paul.

John Alexander McGrew (M. '15) retired engineer and inventor of Albany, N.Y., died there on May 7, at the age of 79. He had been granted 72 patents by the U.S. Patent Office. After graduating from Ohio State University, Mr. McGrew worked for several railroads, including the Pennsylvania, the Chicago, Rock Island & Pacific, and the Delaware & Hudson Company. He was associated with the latter from 1909 until his retirement in 1939 as special assistant to the general manager, except for a brief interlude as a major in the Engineer Corps, during World War I.

Charles Walter Palmer (M. '14) a consulting engineer, died at his home in Wyncote, Pa., on May 8. He was 80. Mr. Palmer had been connected with the firm of Pepper & Register, Philadelphia, Pa., as an engineer and general superintendent; with the American Pipe Manufacturing Co., of the same city, as assistant engineer; and served the Philadelphia Department of Public Works for a four-year period. Since 1908 Mr. Palmer had been in private practice in Philadelphia.

Harry Ralph Standiford (M. '24) construction supervisor for the J. G. White Engineering Corp., New York, N.Y., died there on June 1. He was 65. Mr. Standiford worked at several American Bridge Company plants from 1910 until 1915, the Sperry Engineering Co., New Haven, Conn., from 1915 to 1918, and the J. G. White Engineering Co., from 1918 to 1921. Before rejoining the H. G. White Co., in 1941, he was associated with the William F. Kenny Co., as assistant chief engineer for 11 years and as plant manager of the New Jersey Clay Products Co., for nine years. Mr. Standiford was an alumnus of Cornell University.

Robert Armenac Schroeder (M. '37) assistant director, planning department, Ford Motor Co., in New York, died in Montclair, N.J., on May 30. He was 57. Before joining the Ford Company in 1949, he was director of administrative planning for the Willys-Overland Motors Inc., of Toledo, Ohio, and for 10 years previously had been with the General Motors overseas operations. Mr. Schroeder was also connected with the design of Dnieprostroy Dam, Wilson Dam and other power projects.

Jesse John Woltmann (M. '23) consulting engineer of Bloomington, Ind., died on May 2, at the age of 64. For many years, Mr. Woltmann was a member of the firm, Taylor & Woltmann in Bloomington, specializing in sanitary engineering. Prior to that, he served as city engineer of Anna, Ill., for three years, and city engineer of Nokomis, Ill., for two years. He was associated with several firms in the early part of his career, including Bates & Rogers Construction Co., at Cleveland and Toledo, Ohio, and Chas. W. Brown, consulting engineer of Jacksonville, Ill. Mr. Woltmann was an alumnus of the University of Illinois.

Eugene True Thurston (M. '11) consulting valuation engineer of Oakland, Calif., died in that city on May 3, at the age of 79. Before entering private practice, Mr. Thurston was employed by the San Francisco and San Joaquin Valley Railway, the Southern Pacific Co., J. D. Galloway, structural engineer of San Francisco, and several water companies in the San Francisco area. From 1907 until 1939, he engaged in private practice, and also served as secretary of the General Contractors Association, Inc., from 1917 to 1933. He held the office of superintendent of buildings at Oakland for five years beginning in 1936. Mr. Thurston was a graduate of the University of California.

Thomas Walter Tigertt (J. M. '49) lieutenant, U.S. Air Force, stationed at Wilmer, Tex., lost his life in an accident at Las Vegas, Nev., on February 11. He was 24 years old. Lieutenant Tigertt graduated from the Virginia Military Institute in 1949.

NEWS OF ENGINEERS

C. G. Dandrow, New York Building Congress President

C. George Dandrow, M. ASCE, vice-president of Johns-Manville, was elected president of the New York Building Congress at its thirty-first annual meeting held in New York on May 21. Mr. Dandrow is the first president of the organization outside the architectural field. A second Society member honored was Charles A. Selby, A.M. ASCE, who was named chairman of the Finance Committee. Rear Admiral Joseph H. Jelley Jr., M. ASCE, Chief of Navy Civil Engineers and of the Bureau of Yards and Docks, was the principal speaker.

C. G. Dandrow

Stephen D. Bechtel, president of the Bechtel Corp., San Francisco, Calif., has been named "Alumnus of the Year" by the California Alumni Association and presented with its award for 1951 for "the greatest contribution to international welfare in the year 1951."

Kurt Billig, professor of civil engineering at Hong Kong University, has been appointed by the Indian Government as director of the Central Building Research Institute of India, at Roorkee. Before taking up his new duties, Dr. Billig is going on a lecture tour through Japan. An authority in the field of prestressed concrete, Dr. Billig has lectured widely in the field to professional and university groups all over the country.

Blair Birdsall, since 1940 assistant chief bridge engineer for John A. Roebling's Sons Company, Trenton, N.J., will succeed **Charles C. Sunderland** who is retiring, as chief bridge engineer for the firm.

D. K. Fuhriman, associate professor of civil engineering at the Colorado Agricultural & Mechanical College, has accepted an appointment as associate professor of irrigation and drainage engineering at Utah State Agricultural College. Professor Fuhriman recently received his doctor of philosophy degree in civil engineering from the University of Wisconsin.

Carlton T. Bishop, associate professor of civil engineering at Yale University, is retiring after serving on the faculty continuously for 43 years. Professor Bishop is the author of several books on structural design and drafting.

Harold S. Ellington, of Harley, Ellington and Day, architects and engineers of Detroit, Mich., was presented with the Distinguished Service Award for Professional Achievement in the field of engineering science at the recent alumni reunion dinner of the Illinois Institute of Technology.

Robert J. Allen, chief traffic engineer of the Association of Casualty & Surety Companies' accident prevention department for three years before his recall to active military duty in January 1951, has returned to his former position with the Association, with headquarters in New York City. Mr. Allen saw service in this country, Japan and Korea as an accident-prevention specialist.

(*Continued on page 89*)

Engineers must be leaders in World of Tomorrow

(*Continued from page 37*)

always maintained, standing as we do as arbiters and impartial agents between labor and management, to immediately throw the full weight of our leadership into exposing to public view the fallacious precepts of statism and in restoring man's confidence in man's works. When efforts are being made to socialize medicine, in complete disregard of its abject failure and sterilizing results in England, we should be the first to unite with our sister profession in determined opposition. Socialization of engineering would quickly follow that of medicine, and then invention and technological advancement would be stultified, as inevitably happens to all creative effort under the sterile influence of paternalism.

When labor leaders drive headlong for feather-bedding of jobs, enforced reductions in labor's productivity and a merry-go-round of wage inflation, as the price of their support of an American super-state, we should point out to labor that this has been the pattern in the projection of every totalitarian government to date, and that once firmly established, every super-state has immediately relegated labor to the level of serfdom.

When in the name of the American super-state, an attempt is made to take over a national industry, such as steel, we should immediately point out that this again is in the pattern of statism's development—that Lenin, Hitler, Mussolini and Peron all expropriated industry, segment by segment, under the pretext of a national defense emergency.

Insidiousness of Statism

For statism, in its insidious usurpation of the rights, liberties and incentives of the individual, may in its end result be more permanently destructive to human rights than Communism, because it is being approached through a perversion of the democratic process, whereas Communism has only been enforced on any people through a police state supporting a ruthless dictatorship.

Of all groups in our entire economy, none in their daily work and in their essential attitude toward the accomplishment of their jobs so completely refute these politico-economic doctrines as does the engineer.

Stand up and be counted now, if you are to lay any claim to the plaudits coming to our profession for its important place in our Centennial's depiction and celebration of our 100 years of engineered progress, and if you aspire to the hope of an exten-

sion of that progress through the engineer's continued creative and cooperative effort.

We have talked of engineering leadership for years but the time has come when the profession must replace talk by action. The high status which the profession should have will only be achieved when it has demonstrated the quality of leadership in education and in public affairs of which it is so eminently capable.

The hour is late, but not too late, if we will but do our part and remember that great injunction of 1900 years ago, never more timely than it is today, "What does it profit a man if he gain the whole world but lose his own soul?"

NEWS OF ENGINEERS

(*Continued from page 86*)

Charles L. Miller, a recent graduate of the Massachusetts Institute of Technology, has been named by Michael Baker, Jr., Inc., of Rochester, N.Y., as assistant to the district engineer of southern operations at Jackson, Miss. Mr. Miller has been associated with the Baker Engineers since 1945 on summer work.

Edward J. Nunan, of Buffalo, recently took office as president of the New York State Society of Professional Engineers. Mr. Nunan is materials engineer and sales manager for New York State of the Buffalo Slag Company and affiliated companies.

Paul G. Peterson, plant engineer at the Corning Glass Works, Danville, Ky., has been promoted to supervisor of engineering in the manufacturing planning department of the company's main plant at Corning, N.Y.

Carlton S. Proctor, ASCE President, was recently granted the honorary degree of doctor of engineering, by the Drexel Institute of Technology, Philadelphia. Colonel Proctor was baccalaureate speaker at the University of Kansas City, Kansas City, Mo., on June 1.

H. A. Sawyer has been elected president of the Lone Star Cement Corp., New York, N.Y. He was formerly vice-president in charge of the Louisiana division of the company, with headquarters in New Orleans. Mr. Sawyer has been associated with Lone Star since 1925, serving in New York, Texas, and Louisiana. While in New Orleans he has been in the Louisiana Section of the Society, which he served as president in 1937.

John S. Seybold, brigadier general, Army Engineers Corps, has assumed duties as Governor of the Panama Canal, succeeding **Brig. Gen. Francis K. Newcomer,** retired. General Seybold also is president and a director of the Panama Canal Company, which handles the business and operation of the canal.

(*Continued on page 90*)

(*Continued from page 89*)

Walter H. Wheeler, consulting bridge and building engineer of Minneapolis, Minn., has received the Outstanding Achievement Award from the University of Minnesota, with a citation for "Outstanding professional achievement as consulting construction engineer, adviser to national committees on engineering standards, international builder, farsighted inventor and designer."

Walter H. Wheeler

Arsham Amirikian, chief designing engineer of the Bureau of Yards and Docks, Washington, D.C., has received the Concrete Reinforcing Institute Award for 1952 for his work in thin-shell precast concrete. The award consisting of a certificate and $500 was presented during the 28th annual meeting of the Institute, held at White Sulphur Springs, W. Va.

Henry Townley Heald, chancellor of New York University, and **Harland Bartholomew,** president of Harland Bartholomew & Associates, St. Louis, Mo., received honorary degrees from Rutgers University at its recent commencement exercises.

Joseph Marin, professor of engineering mechanics and research professor of engineering materials at Pennsylvania State College, was recently awarded a Fulbright Professorship to lecture at the Technological Institute at Trondheim, Norway, for the academic year 1952–1953.

Sol M. Gleser, engineer with the Upper Mississippi Valley Division, Corps of Engineers, was recently presented with an award for Meritorious Civilian Service in recognition of his "initiative and untiring efforts in the study of protective coating materials and methods of application. . . ."

J. D. Hancock, engineer with the U.S. Bureau of Reclamation, has been transferred from their Washington offices to Baghdad, Iraq, to participate in development projects in the Middle East under the Point IV Program.

Charles Herbert Capen, Jr., president of the American Water Works Association and chief engineer of the New Jersey District Water Supply Commission, is the recipient of an honorary doctorate of engineering recently awarded by the Newark College of Engineering.

William A. Carver has completed the course leading to the bachelor of law degree (L.L.B.) at night law college (the McGeorge College of Law, Sacramento) while in the position of associate estimator of building construction, Division of Architecture, Department of Public Works, State of California.

Roger B. Buettell, Jr., and **William R. Dorer** announce the organization of Dorer-Buettell, Inc., general contractors, specializing in industrial and commercial construction. Offices have been established in Cleveland, Ohio.

Morris M. Cohn, city manager of Schenectady, N.Y., recently received the honorary degree of doctor of science from Union College, his alma mater, in recognition of 31 years of civil engineering service to the city. Until recently Mr. Cohn was public health engineer. Mr. Cohn's son received his bachelor's degree in the recent commencement exercises honoring him.

James O. Colvard, Jr., formerly engineer and land surveyor with Colvard, Thomas & Timberlake, Decatur, Ala., is now in charge of the civil engineering practice of the firm of Albert R. Frahn & Associates, architects and engineers of Decatur.

Robert E. Cron, colonel, Corps of Engineers, U.S. Army, was assigned to duty with the military mission to Brazil following his graduation from the Industrial College of the Armed Forces, Washington, D.C., on June 19.

E. W. Fickenscher has joined the firm of Seelye Stevenson Value & Knecht, consulting engineers, of New York City. Mr. Fickenscher, formerly division engineer with H. K. Ferguson Co., New York City, will be in charge of the department of bridges and heavy engineering structures.

Charles H. Buckius has been promoted from assistant chief engineer to chief engineer of the Pennsylvania State Highway Department. Except for two brief interludes, Mr. Buckius has been in state service since 1907.

Carlos M. Passalacqua, a member of the Puerto Rico Planning Board, has been appointed development vice-president of the Puerto Rico Industrial Development Company, at San Juan. His new assignment includes planning for factory location and industrial estates, and design and construction of factory buildings.

C. M. Passalacqua

Herbert D. Vogel, former lieutenant governor and engineer of maintenance of the Panama Canal Zone Government, is now Southwestern Division Engineer for the Corps of Engineers at Dallas, Tex.

William A. Robinson, field engineer and superintendent for the Dravo Corporation, Pittsburgh, Pa., has been promoted to assistant chief engineer of the contracting division of the company.

(*Continued on page 92*)

G. Donald Kennedy, until recently assistant to the president and consulting engineer for the Portland Cement Association, has been promoted to vice-president of the organization. Mr. Kennedy joined the Association in January 1950 after serving as Michigan State Highway Commissioner and vice-president of the Automotive Safety Foundation. As chairman of the Society's Technical Program Committee, Mr. Kennedy is coordinating the programs of the Technical Divisions for the ASCE part of the forthcoming Centennial celebration in Chicago.

G. Donald Kennedy

Samuel C. Jacka, assistant city engineer and chief of the engineering division at Berkeley, Calif., has been named director of public works for Oakland, Calif., succeeding **Richard Gallagher.**

Joseph K. Knoerle, of Baltimore, Md., announces that he has entered private practice with offices at 824 North Calvert Street, Baltimore. Mr. Knoerle was formerly associated with the J. E. Greiner Co., of the same city, as senior associate engineer.

M. L. Brashears has been made a partner in the ground water geology consulting practice established by **R. M. Leggette** in New York City in 1944. Mr. Brashears' previous experience includes work as a specialist in ground-water investigations with the U.S. Geological Survey, the U.S. Navy and the Atomic Energy Commission.

Loren Clark Bishop, state engineer of Wyoming, has been awarded an honorary degree by the University of Wyoming. In addition to being state engineer, Mr. Bishop is director of the Wyoming natural resources board, interstate streams commissioner, and secretary of the Wyoming state board of examining engineers. He is a past-president of the Wyoming Section of ASCE.

Solomon Cady Hollister, dean of the College of Engineering, Cornell University, was one of four alumni recently receiving honorary degrees from their alma mater, the University of Wisconsin.

A. J. Van Dyke, resident engineer, Texas Highway Department, Jacksboro, Tex., has accepted a position as adviser to the Minister of Public Works of the Republic of Peru. His address will be Asociacion Peruana de Caminos, Lima, Peru.

Clarence Carl Neher, after 39 years' service with the Corps of Engineers, has retired from his position as civil engineer in the Baltimore District. He was honored at a recent luncheon, at which he was presented with a special meritorious award for his long and valued service.

(*Continued on page 96*)

ENGINEERING SOCIETIES PERSONNEL SERVICE, INC.

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Men Available

Civil Engineer; member of ASCE Student Chapter; to graduate in June 1952; Colombian citizen by birth; 5 years of study at accredited school; practical work in the United States and Europe; interested in construction work; desires position with engineering company working in Colombia. C-756.

Civil Engineer; A.M. ASCE; married. Speaks Spanish, English and French. Seeks position as sales engineer in Central America or the Caribbean area. Reliable. C-757.

Civil Engineer; A.M. ASCE; B.S. in C.E.; 37; Virginia Polytechnic Institute, class of 1938; registered; member of the National Society of Professional Engineers; 14 years' experience in construction, design, surveying, and maintenance, including military posts and airfields, shipyard railroads and hospitals. C-758.

Civil Engineer; J.M. ASCE; 27; married; B.S. in C.E., June 1949; 3 years' experience in supervision of dredging, marine construction, namely, barges, docks, pile driving, tow boats, and bulkheads; the operation of a specification sand plant. Desires permanent position—will consider overseas employment. C-759.

Sanitary Engineer; A.M. ASCE; licensed; advanced degree. Progressive industrial experience in design and operational phases of waste disposal, pollution control, water supply and water treatment. C-760.

Civil Engineer; A. M. ASCE, AMICE (England); 35; single; Scotsman; 11 years' experience roads, sewers, main drainage including precast segment tunnel work, reinforced concrete culverts, retaining walls, framed buildings; experience on design and site. Desires position with American firm of consulting engineers or contractors in any area. C-761.

Civil Engineer; J. M. ASCE; 30; married; B.S. in C.E., January 1949; 1 year as draftsman, structural and machinery layout; $2^1/_2$ years' supervision of erection of coal preparation plants. Desires responsible position, construction or liaison. C-762.

Civil Engineer; M. ASCE; registered; diversified experience, construction, supervision, design on industrial buildings, waterworks, sewerage systems, etc.; utility operation. Presently with consulting engineer. Desires position with engineer, contractor or owner as project manager, project engineer, superintendent of utility operation. Has operated own contracting business; has been on major defense projects. C-763-357-Chicago.

Junior Civil Engineer; J. M. ASCE; 26; married; B.S. in C.E., June 1951, University of Missouri; over 2 years' experience in construction of bridges, including spiraled bridges and highway, both field and office. Desires position in construction to eventually enter consulting field. Prefers eastern location. C-764-523-A-7-San Francisco.

Positions Available

Engineers. (a) Waterworks Engineer, senior, experienced in operation, management and construction of water utility plants, to direct hydraulic studies and design for improvements, in addition to directing supervision of operation. (b) Junior Engineer, recent civil graduate, interested in waterworks utility plant. Salaries open. Location, New York State. Y-6604.

Civil Engineer experienced in water supply and/or dam design studies and reports. Location, Pennsylvania. Y-6607.

Civil Engineer, graduate, with at least 8 years' design and field experience on waterfront construction, pumphouse, office building, tank foundations, to design bulk terminals with occasional field inspection work. Salary, $6,000–$8,000 a year. Location, New York, N. Y. Y-6647.

Construction Superintendent, civil graduate, 35–45, with at least 5 years' field engineering and supervisory building construction experience, to take charge of housing projects, hospitals, etc., for general contractor. Salary, $6,000–$9,000 a year. Location Panama and Caribbean area. Y-6655.

Foundation Engineer with 10 years' experience designing heavy foundations and bridge piers. Advanced degree in structures desirable. Knowledge of soils mechanics essential. Capable of departmental responsibilities in small organization. Location, East. Y-6776.

Graduate Engineers, preferably civil, for hydrography division of service organization furnishing information to federal, state, municipal and private agencies in problems dealing with natural water resources. Should have sound basic engineering background for work of specialized nature. Company will train. Salary, $3,870 a year. Location, Pennsylvania. Y-6780.

Special Assistant to the Director of Installations, with broad background of experience, preferably in civil or construction fields, plus executive and staff management experience. Duties will include construction coordination, program development, material allocation. Salary, $13,000 a year. Location, Washington, D.C. Y-6907.

Engineers. (a) Structural Engineer with minimum of 5 to 10 years' experience in industrial plant, particularly chemical construction. Salary, $7,800 a year. (b) Sanitary Engineer for project leader, on design of sewerage plant and sewerage collection. Salary, $7,200 a year. Location, Georgia. Y-6932.

Instructor or Assistant Professor in Civil Engineering, to handle instruction in surveying. Must have advanced degree. Salary open. Location New England. Y-6950 (a).

Instructor to teach civil engineering courses. Master's degree required. Position starts September 1952. Salary, $3,600–$3,800 for nine months. Location, Ohio. Y-7021.

Assistant Engineer for city engineering office, about 50, with at least 5 years' municipal engineering experience. Salary open. Location, New York State. Y-7036.

Sales Engineer, civil graduate, 23–30, with some highway or airfield construction and maintenance experience to sell asphalt products and accessories. Salary, $4,500 a year plus expenses. Location, Long Island, N.Y. Y-7043.

Civil Engineer with B.S. degree in engineering, and $2^1/_2$ years' experience in civil engineering, with good knowledge of engineering principles and the ability to perform engineering work of greater than ordinary difficulty under only very general supervision. Assignments will include field and office work on new construction and modifications. Salary, $5,940 a year. Location Connecticut. Y-7049.

Hydraulic or Sanitary Engineers, 35–40, technical graduate, experienced in this field, capable of structural and hydraulic design for company in the municipal field involving investigations, reports, design and supervision of construction of water supplies, treatment and distribution, sewage collection and treatment, airfields, storm drainage, streets and related types of work. Should be able to make investigations and prepare engineering reports, meet and discuss projects with clients. Should have Southern background. Salary open. Location, South Carolina. Y-7070.

Architectural Engineer with training and experience in the field, to develop the use of plastics in architectural applications. Duties will include discussing installation details with contractors and builders, and ability to make suggestions for overcoming some of their problems by the use of plastics. Should have a degree in architectural engineering and from 1 to 5 years' experience. Salary open. Location, Pennsylvania. Y-7104.

Civil Engineer, under 40, with structural design and office engineering experience, to prepare plans, specifications, etc., on oil field construction projects. Salary, $11,640 a year base pay, plus $4,200 a year living allowance. Location, South America. Y-7112.

Construction Superintendent, 35–50, with at least 10 years' building and general construction experience, to take charge of job for contractor on government project. Must have good well-point unwatering and large volume concrete placement experience. Salary, $8,000–$10,000 a year. Location, Florida. Y-7113.

Civil Engineer, 45–55, graduate, to act as architect-engineer representative reporting to resident engineer covering construction engineering, interpretation of plans and specifications field changes in design, job specifications, and surveys, including recommendations for modifications of airfields and buildings. Single status only. Salary $10,000–$12,000 a year. Location, foreign. Y-7151.

Civil Engineer, young, graduate, preferably with some experience in the maintenance of track and track equipment, for work in railroad department. Summer experience acceptable. Salary open. Location, Chile. Y-7154 (a).

Engineer for sewage and water treatment work, preferably one capable of gathering information from the field and reducing it to paper in the office in the form of reports and designs. Salary open. Location, Georgia. Y-7160.

General Superintendent of Construction to take charge of construction of a paper mill abroad. Must have paper mill construction experience. Salary open. Y-7170.

Chief Engineer, B.S. in civil, architectural or mechanical engineering, with from 8 to 12 years' engineering in industry; background in refrigeration equipment, food processing, hardware design or insulation helpful. Will be responsible for leadership in field of product development; proper application of product to meet customers' needs; adequate manufacturing instructions; supervision of drafting personnel. Company manufactures cold storage doors and employs about 200. Salary, about $8,000 a year. Location, mid-Atlantic States. Y-7178.

Chief Engineer, mining graduate preferred, but will consider civil or mechanical with about 10 years' experience, to include either construction or underground operations. Mining is open pit but transportation problem is involved, so applicant should have some experience in mechanized operation. Transportation paid; housing available; salary open. Location, West Indies. Y-7180.

Engineer, B.S. in civil engineering or equivalent, to include most of the following courses: Dynamics, aerodynamics, differential equations, statistics, stress analysis, structural design. To plan, conduct and evaluate field tests of operational engineering techniques. Will consider a recent graduate. Salary, $3,410–$5,940 a year. Location, Virginia. Y-7202.

Field Engineer, sanitation, 25–35; with at least 2 years' experience in sewerage work or treatment plants. Duties will include office and field work handling promotional or consulting work relative to cement or concrete for sewerage or treatment plants. Salary, $4,800–$6,000 a year. Employer may negotiate fee. Travel 20 percent of time. Headquarters, Chicago, Ill. R-8970.

Field Engineer, graduate civil, up to 30; with at least 1 year's experience in highway, construction, inspection or soils work. Knowledge of soils or highways. Will assist in promotion and technical servicing of soil cement streets, roads and airports. Contact builders, construction engineers and users. Salary open. Employer may negotiate fee. Travel 50 percent of time. Headquarters, Chicago, Ill. R-8984.

(Continued from page 92)

Harold J. Lewis, soils engineer for the Pennsylvania Turnpike Commission, at Ellwood City, Pa., was recently appointed county engineer for Etowah County, Alabama, with headquarters at Gadsden. In the past Mr. Lewis was also associated with E. I. du Pont Co. at Hanford, Wash., and Childersburg, Ala.

Lester Long, formerly assistant general sales manager for the American Cast Iron Pipe Co., Birmingham, Ala., has been elected vice-president in charge of sales and secretary of the firm. Mr. Long, who has been with the company for 37 years, succeeds J. J. Swenson, who is retiring.

Ned Williams, former director of the AEC's Oak Ridge Office of Production and Engineering, was named to head the newly-created Construction Area unit, in a general reorganization of the Oak Ridge Operations Office.

George Winter, head of the structural engineering department at Cornell University, will present a paper on light gage steel structure at the fourth congress of the International Association of Bridge and Structural Engineering, to be held at Cambridge, England, in September.

Abel Wolman, professor of sanitary engineering at Johns Hopkins University, was recently appointed consultant in sanitary engineering to the U.S. Air Force.

Norman B. Wood, principal highway engineer for the U.S. Bureau of Public Roads, has been assigned as resident engineer on the Inter-American Highway project in the Republic of El Salvador. He was formerly chief of the Bureau's highway mission to Peru.

Arnold A. Zimmer has been promoted from trainee to assistant to the superintendent at the Rankin Plant of the Bethlehem Steel Company's Fabricated Steel Construction Division at Pittsburgh.

Solution to problem on page 45

During the night the top of the slab cools and shrinks, causing the edges to curl upward, away from the subgrade, and making them vulnerable to concentrated wheel loads and impact. During the day the sun heats the upper surface of the slab causing it to expand, raising the crown slightly, and tending to press the edges against the subgrade. This arching of the crown robs it of support from the subgrade and makes it more vulnerable to stress and impact from heavy concentrated wheel loads. Only a very small gap between slab and subgrade allows enough play for damaging stress effects to take place in either case.

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33	Foundation Problems at Trenton Dam, Nebraska Ellis Armstrong, 36 pages	Soil Mechanics	☐
34	Channel Stabilization—Missouri River Raymond L. Huber, 16 pages	Waterways	☐
35	Correlation of Runway Design Procedure Robert Horonjeff, 24 pages	Air Transport	☐
36	Denver-Boulder Turnpike, Colorado Roderick L. Downing, 16 pages	Highway	☐
37	Power Features—Colorado—Big Thompson Project S. Denton and H. L. Neve, 40 pages	Power	☐
38	Novel Features, Diversion and Outlet, Boysen Dam, Wyoming Ralph W. Whinnerah, 16 pages	Power	☐
39	Canal and Locks at Chain of Rocks, Mississippi River A. F. Griffin, 16 pages	Waterways	☐
40	Upper Minneapolis Harbor, St. Anthony Falls, Minn. L. G. Yoder, 24 pages	Waterways	☐
41	Surveying and Mapping in Alaska Gerald FitzGerald, 12 pages	Surv. & Mapping	☐
42	Algae Responsible for Taste and Odor, in Public Water Supplies George J. Turre, 8 pages	Sanitary Eng.	☐
43	Denver's Master Street Plan John S. Marshall, 16 pages	City Planning	☐
44	Traffic Engineering and Mass Transportation Henry A. Barnes, 8 pages	City Planning	☐
45	Construction of Granby Dam, Colorado Ed. H. Honnen, 8 pages	Construction-Structural	☐
		TOTAL	

American Society of Civil Engineers
33 West 39th Street, New York 18, N. Y.

Please send......copies of Denver Convention Preprints as checked in above list at $0.25 each. Enclosed is check (or money order) in the amount of $............

Name...

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Positions Announced

Corps of Engineers. The New York District of the Corps of Engineers needs experienced engineers in the following fields for work on civil and military projects: Hydraulic engineer at $5,940 a year; materials engineer at $5,060 a year; cartographic compilation aide, $4,205 a year; and hydraulic engineer at $4,205. The work will be located in New York and New Jersey. Applicants should communicate with the Personnel Branch of the New York District office, 80 Lafayette Street, New York 13, N.Y.

Corps of Engineers, Foreign Opportunities. Announcement has been made by the New York District, Corps of Engineers, of the availability of positions in Alaska as hydraulic engineer and construction engineer at $5,060 a year; engineering aides at $2,950–$4,205; engineering draftsmen at $3,175 to $3,795; civil and structural engineers at $3,410 to $5,940; soils engineer at $7,040; and materials engineer at $3,410 to $4,205. In Puerto Rico there is an opening for a civil engineer at $5,060 a year. In Austria civil engineers at $5,060 a year, and an architectural engineer and construction management engineer at $5,940, are needed. Other opportunities are available in Japan and Okinawa. All positions are for a two-year period. A 25 percent cost of living allowance is made. Interviews are held from 9 a.m. to 4 p.m. on Mondays through Fridays, New York District, Corps of Engineers, 80 Lafayette St., New York, N.Y., on the 4th floor, personnel branch. Applicants residing outside the New York area should apply to the Engineer District office nearest their residence.

Non-ASCE Meetings

International Association for Bridge and Structural Engineering. The fourth congress of the International Association for Bridge and Structural Engineering will be held at Cambridge and London, England, from August 25 to September 5. Further information may be obtained from the Secretary of the IABSE, Swiss Federal Institute of Technology, Zurich, Switzerland.

Society of Automotive Engineers. Headquarters for the national west coast meeting of the Society of Automotive Engineers, scheduled for August 11 to 13, will be the Fairmont, San Francisco, Calif.

University of Illinois, Civil Engineering Alumni. A 25th annual reunion dinner of all civil engineering graduates of the University of Illinois will be held at 7 p.m., in the Upper Tower Room of the Conrad Hilton Hotel, Chicago, on Tuesday, September 9. This dinner, usually held at the time of the ASCE New York Convention, will take place this year in connection with the Centennial of Engineering, 1952.

RECENT BOOKS

Compléments D'Hydraulique

These two volumes, by L. Escande, contain published accounts of various researches in the field of hydraulics. Among the topics considered are flow in open channels; hydraulic models and similitude problems; the operation of hydraulic valves and gates; water hammer and surge chambers, including graphical methods for the solution of problems; and a variety of detailed analyses of special hydraulic conditions. (Vol. I: Eduard Privat, Toulouse, 1947. 220 pp., Frs. 1,500. Vol. II: Dunod, 92 Rue Bonaparte, Paris 6ᵉ, 1951. 248 pp., Ffrs. 3900.)

Béton Précontraint

This book by Y. Guyon is a comprehensive treatise on prestressed concrete covering, in its first section, the fundamental concepts, basic methods of prestressed construction, materials used, reasons for loss of tension, stresses, and resistance to fire. Section II deals with the analysis and calculation of prestressed units with different types of reinforcement and under various conditions. Section III describes test methods, investigations of cracking and failure, the determination of safety factors, and several special aspects of the problem. (Institut Technique du Batiment et des Travaux Publics, 28 Boulevard Raspail, Paris VIIᵉ, France, 1951. 702 pp., ffrs. 4,500.)

(The) Design and Placing of High Quality Concrete

A detailed study of concrete and its making and placing written to illustrate the new techniques that have arisen from recent research. The author, D. A. Stewart, shows how greater strength can be obtained as well as economy in the use of materials by designing each mix for the purpose in hand, and how the limitations placed on the material in the past have been consequently modified. (E. & F. N. Spon Limited, 22, Henrietta St., London, W. C. 2, England, 1951. 112 pp., 25s.)

Nomography and Empirical Equations

Two useful techniques are provided by the author, Lee H. Johnson, for handling experimental and operational data in business, industry, professional practice, and research. In the first part, the characteristics and construction of nomographs are explained with examples of applications of various types. The section on empirical equations explains the methods of fitting curves to plotted data and establishing the corresponding equations. Proportional charts for laying out uniform scales are provided at the back of the book. (John Wiley and Sons, Inc., 440 Fourth Ave., New York, 16, N.Y., 1952. 150 pp. $3.75.)

(The) Resistance of Piles to Penetration

Based on Hiley's pile-driving formula, this second edition of a standard work on the bearing power of piles by Russell V. Allin, is of use for both design purposes and the selection of plant and driving operations on the site. Primarily composed of tables, it takes into account the effects on the ultimate resistance to penetration of different driving conditions such as weight, drop, and types of hammer, quality of pile, the batter to which it is driven, type of cushion employed, and condition of the pile head at the end of the drive. Tables of approximate values based on the Hiley formula, are also included. (E. & F. N. Spon Ltd., 22, Henrietta St., London, W. C. 2, England, 1951. 126 pp., 21s.)

Rigid Frame Formulas

Explicit formulas are given by A. Kleinlogel, of all statical quantities for 114 rigid frame shapes which occur in practical steel, reinforced concrete, and timber construction. General and special load conditions are considered including temperature changes. The pictorial representation allows the use of the formulas for bending moments and reactions without advanced training. With training a rapid method is provided for computing displacements. The rigid frames given can be used as units in dealing with more highly indeterminate structures. (Frederick Ungar Publishing Co., 105 East 24th St., New York 10, N.Y., 1952. 460 pp., $10.)

Die Statik der Bauwerke

This second volume of *Die Statik der Bauwerke* (Formänderungen statisch bestimmter ebener Fachwerk- und Vollwandträger- Allgemeine Theorie der statisch unbestimmten Fachwerk- und Vollwandträger) by Rudolf Kirchoff, is a detailed mathematical analysis of trusses and web girders. Part I deals with the calculation of deformations of statically determinate elements, and Part II develops the general theory of statically indeterminate elements. A wide range of cases and structural types is covered. Together with Volumes I and III a full treatment of the statics of structures is provided. (Verlag von Wilhelm Ernst & Sohn, Hohenzollerndamm 169, Berlin-Wilmersdorf, Germany, 5th edition, 1951. 368 pp., D.M. 24.00.)

Symposium of Structural Sandwich Constructions

Eight papers with discussion, presented at the fifty-fourth annual meeting of ASTM, comprise this pamphlet. Topics covered include developments and trends in lightweight composite construction; various physical and mechanical properties of sandwich constructions; the use of paper or aluminum honeycombs and a variety of inorganic materials for sandwich cores; and fabrication techniques. (American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa., Special Technical Publication No. 118, 1952. 114 pp., $2.)

Travaux Maritimes

This third volume by G. DeJoly, P. H. Watier, Ch. Laroche, and A. DeRouville, entitled *Travaux Maritimes*, is part of a comprehensive series "Ouvrages Intérieurs et Outillage Des Ports." It covers the arrangement and management of harbors; the construction of quays and docks of various types; equipment for building, launching, and maintaining ships; harbor bridges, locks, and sluices; dredging and cargo-handling equipment; and the administration of commercial seaports. The treatment is detailed and well illustrated. The first 700 pages are a reprint of the 1940 edition, but a 100-page supplement covers the principal developments during the succeeding ten years. (Dunod, 92, Rue Bonaparte (VI), Paris, 1951. 808 pp., Ffr. 3500.)

Wasserbau. Teil 1, Der Flussbau. (Technische Handbücher für Baupraktiker, Band 2, Teil 1).

Based on work done at a Swiss water experiment station, this book by J. Duhm, the first part of a set on applied hydraulics, is concerned with river engineering. Following a review of hydrological fundamentals, procedures used in hydrometric studies are discussed. The flow of water in natural beds, its use as a source of power, and its control are all considered. Canal construction, the design of banks and the strengthening and construction of dams are all dealt with. (Verlag Georg Fromme & Co., Vienna, Austria, 1951. 491 pp., $6.25.)

(The) Welding Encyclopedia

The 13th edition of The Welding Encyclopedia, revised and re-edited by T. B. Jefferson covers all terms from abrasion to zirconium relating to the broad field of metal joining and cutting by application of heat, including heat-treating processes and other allied subjects. Photographs, line drawings, graphs, data tables, and equilibrium diagrams are extensively used to illustrate or amplify the text. Pertinent codes, standards, and specifications are appended, and there is a 90-page list of trade names with descriptive information. The volume has been revised throughout in accordance with current practice. (McGraw-Hill Book Co., 330 West 42nd St., New York 36, N.Y., 1951. 1,008 pp., $7.50.)

Applications for Admission to ASCE, May 17–June 7

Applying for Member

Roy Horatio Anderson, Chicago, Ill.
Jean Marie Louis Antoine Aubert, Paris, France.
Crispin Ayala-Durate, Malaga, Spain.
John Ernest Bing, Atlanta, Ga.
Eugene Hudson Carter, Fort Worth, Tex.
Loh-Kwan Chen, Hong Kong, China.
Edwin Blaine Cobb, Boston, Mass.
Philip Pease Dickinson, Sacramento, Calif.
Robert Mario Donnelly, Atlanta, Ga.
Niranjan Das Gulhati, New Delhi, India.
Edmund Rutherford Foster, Jr., Norfolk, Va.
Otto Gottschalk, Argentina, S.A.
Edmund Kirby-Smith, Galveston, Tex.
Kalman Hajnal-Konyi, London, England.
Dale Wayne Mattson, Cookeville, Tenn.
Harry Eugene McWilliam, Clinton, Ill.
Ernest Eerno Merey, New York, N.Y.
Andrew Currier Paton, Boston, Mass.
Joseph Francis William Smith, Rolla, Mo.
Harry Charles Sprague, Ephrata, Wash.
William McCray Simpson, Port Hueneme, Calif.
George Stern, New York, N.Y.
Dionisio Fernando Suarez de la Portilla, Havana, Cuba.
Thomas Michael Sullivan, New York, N.Y.
Lorin Homer Williams, Jefferson City, Mo.

Applying for Associate Member

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Darwin Chang, New York, N.Y.
Allen Fraser Clark, Jr., Memphis, Tenn.
John Regan Cullings, St. Louis, Mo.
Frank Harold Davis, Los Angeles, Calif.
Wesley Espy, Savannah, Ga.
Elvet Joseph Evans, London, England.
George Edwin Fieldhouse, Philadelphia, Pa.
Vincent Fitz-George Foster, Jamaica, B.W.I.
George Loren Fuller, Spartanburg, S.C.
Peter Harrison Grayum, Oakland, Calif.
Arnold Julian Hanson, Fairbanks, Alaska.
Hilbert Louis Hoffman, Indianapolis, Ind.
Christopher George Hopkins, Nashville, Tenn.
Claude Robert Hunter, Lamor, Colo.
Roy Forest Linsenmeyer, Swarthmore, Pa.
George Henry Lloyd, Jr., Cleveland, Ohio.
George Woodrow McKellar, Salt Lake City, Utah.
Walter William Miller, Fresno, Calif.
Paul Edmund Mitchell, Bethlehem, Pa.
Harold Oscar Ogrosky, Washington, D.C.
Henry Whipple Parker, Minneapolis, Minn.
Donald Lowden Perley, Cape Town, South Africa.
Vernon Russell Peterson, Missoula, Mont.
Myron Elliott Potter, Jr., Williamsburg, Va.
Victor Sardi, Caracas, Venezuela.
Richard Alfred Schnarr, River Falls, Wis.
Carleton Boone Stetson, Denver, Colo.
Joseph Clemens Weber, New York, N.Y.
Richard French Wittenmyer, Cleveland, Ohio.

Applying for Junior Member

Richard Frank Batchen, Buffalo, N.Y.
Charles Fred Beck, Chicago, Ill.
Frederick Barnes Bunting, Victoria, Australia.
Gordon Donald Campbell, West Lafayette, Ind.
Roland Hayes Dix, Washington, D.C.
Richard Dreselly, Boston, Mass.
Sam Hanna Gaddy, Dallas, Tex.
Alfred Ross Hales, Jr., Pittsburgh, Pa.
Dominck Pete Insana, Cleveland, Ohio.
John O'Donnell Magnus, Boston, Mass.
Rufus Harley Musgrove, Ocala, Fla.
Robert Charles Sevitz, Long Beach, Calif.
George Nelson Sisson, Dayton, Ohio.
Charles Robert Supplee, Cambridge, Mass.
Philip John Vedros, Jr., Vicksburg, Miss.
William Michael Wehner, Cleveland, Ohio.

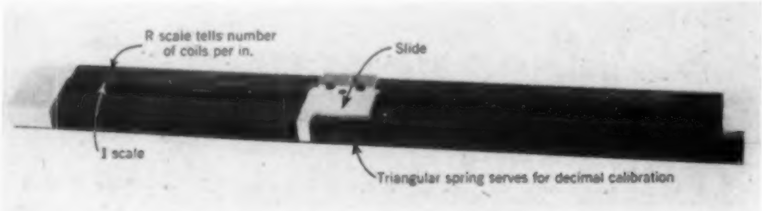
[Applications for Junior membership from ASCE Student Chapters are not listed.]

EQUIPMENT, MATERIALS and METHODS

NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS

Variable Scale

Proportioning, dividing and multiplying distances in maps, graphs and drawings is greatly facilitated by a new variable scale. The scale, using a specially designed calibrated spring for the decimal calibration can be set at almost any scale. Move the slider to the left, and the marked loops of the spring furnish small-scale readings, move the slider to the right, and the spring expands to give a larger scale. Among the many uses of the scale are the dimensioning of drawings to odd scales, construction layouts, contouring, vector addition, center of gravity location, reading trigonometric functions, interpolation, converting units and interpreting aerial photographs. By speeding tedious scaling and proportioning operation, the instrument (made of black anodized aluminum) should save engineering costs. **Gerber Scientific Instrument Co., 89 Spruce St., Hartford 1, Conn.**



Speeds Proportioning of Distances

Oil Booster

The introduction of a heavy-duty, high temperature oil booster has been announced. The oil booster is a self-contained fully automatic heating unit operating on the principle of a closed heating system, vented to atmosphere. It provides higher temperatures with lower fuel costs and less maintenance. Features of the sturdily constructed oil booster include quicker heating, reduced maintenance, quicker shutdown, positive heat circulation, higher temperatures, lower operating costs and trouble-free design. **Cleaver-Brooks Company, 326 East Keefe Ave., Milwaukee 12, Wis.**

Corrugated Metal Culverts

The introduction of nestable corrugated metal drainage pipe, is announced. Nestable pipe consists of flanged half-round sections which are bolted together in the field to form tight, continuous conduits. Shipped knocked down, it requires only about 10 percent of the shipping space of full-round, factory-assembled pipe, which is Penco's principal drainage product. Nestable pipe is the most practical type of drainage pipe for overseas shipment and long overland hauls, even in diameters as large as 7 ft. Though light in weight, it carries heaviest traffic loads when installed under highways, railroads, airports, etc. **Penn Metal Corporation, Front & Oregon Sts., Philadelphia 48, Pa.**

Waterstop

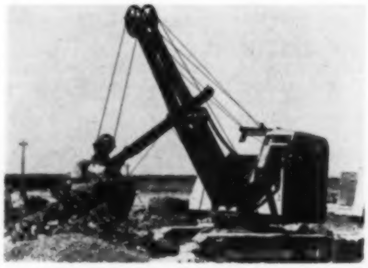
A waterstop for eliminating leakage between adjacent concrete pours has recently been introduced. The Labyrinth waterstop overcomes common objections to the usual strip of rubber, steel or copper. It is nailed directly on to the inside of the form; no special form work is necessary. It can be cut by a knife and sections can be joined by a hot knife or torch. Since pouring of large concrete structures must be limited to divisional blocks in order to allow for dissipating hydration heat, waterstops are always needed to prevent leakage through the cracks which form as the concrete shrinks in setting. To date, the conventional rubber and metal stops have proved difficult to install and all too subject to chemical change. The plastic stops are satisfactory on both counts. Made of tough polyvinyl plastic, they are easy to handle, last indefinitely and are ribbed, grooved and corrugated to form a bond with concrete that maintains its seal under the most severe contraction conditions. The plastic joint seal may be used in architectural concrete structures above ground level, for joints in foundation walls or between foundation walls and floors, and for those hydraulic structures where shrinkage openings no larger than $^1/_2$ in. are expected. When no pressure is encountered, the present seal is said to be satisfactory for even larger shrinkage. **Water Seals, Inc., 400 West Madison St., Chicago 6, Ill.**

Automatic Mix Selection Mechanism

To increase the efficiency of transit mix and central mix concrete operations, a push button control panel that automatically produces 24 different size and type batches of aggregate and cement has been developed. In addition, a "repeater" mechanism provides for uninterrupted automatic re-batching of any one selection a predetermined number of times. The automatic mix selection mechanism is electrically controlled and is installed under the Johnson multiple compartment aggregate and cement bin. Fully automatic single material batchers on each compartment are controlled by the central dial scale unit with pen recording of the weight of each single material batch. A water batcher and a cement batcher that provides for automatic moisture compensation completes the setup. **C. S. Johnson Company, Champaign, Ill.**

Stripper Shovel

Several models of the hi-lift stripping shovel, recently introduced, are working in various sections of the country. Outstanding performance reports on casting operations have been turned in on the excavating unit using both 2 and $2^1/_2$ cu yd dippers, depending on digging conditions. Using the same base machine as the standard $2^1/_2$ cu yd Model 1005, the hi-lift stripper operates with a 50 ft boom and 36 ft dipper stick. This attachment allows a maximum dumping height of 40 ft and a reach of 60 ft with boom angle at 45 deg. By comparison, the standard 1005 shovel attachment, operating by chain crowd, carries a 26 ft boom and standard $19^1/_2$ ft double dipper sticks for heavy duty digging work. Features of the hi-lift design include a single dipper stick with cable crowd and a twin box section boom structure for maximum strength and minimum weight. In addition, the 1005 hi-lift can be converted for lift crane, dragline or clamshell operation. **Koehring Company, 3026 West Concordia Ave., Milwaukee 16, Wis.**

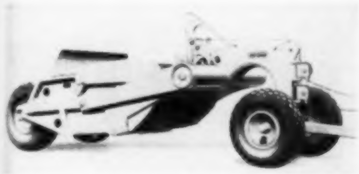


1005 Hi-Lift

Equipment, Materials & Methods (Continued)

Scraper

A No. 60 SCRAPER for use with D6 tractor power is announced. The unit has a flat-bottom bowl and stinger blade engineered for loading and finishing characteristics. The reversible blade cuts a 7 ft 8 in. swath; the bottom is double with steel beam fillers. Capacity of the No. 60



Model No. 60

has been increased to 7 cu yds struck and 9 cu yds heaped. Top extensions or sideboards are available to boost this capacity to 8.3 cu yds struck and 11.5 cu yds heaped. Maximum carrying capacity is 11.5 tons. Also included are such design details as an unobstructed bowl, tapered roller bearings at the axles, induction hardened sheaves and bulldozer-type ejection. Operation is by means of a Cat cable control available for attachment to the tractor. **Caterpillar Tractor Co., Peoria 8, Ill.**

Conveyor

THE CON-VAY-IT Special 12-30 is mounted on both the International Farmall Cub and Super A, and is specially designed for use by contractors. It is being used successfully to handle wet concrete, mortar, bricks, concrete blocks, lumber, etc. It is also used efficiently and economically to pour wet concrete for slabs, foundations, lintels, retaining walls, piers, in fact, wherever wet concrete is used. The Con-Vay-It Special 12-30 overcomes many shortcomings encountered when the conventional or ordinary type conveyor is used to handle wet concrete. When cleats are used the belt cannot be cleaned and the grout adheres and sets up on the cleats and the belt. Hence, cleats are not used. If spool or troughing rollers are used it makes a belt sag between the rollers and the concrete is broken apart and segregated at the high point of the roller or spool. With this method of construction friction is reduced to a minimum and segregation is prevented. When steel scrapers are used it results in excessive wear on the belt and the lacing. Therefore, rubber, wood or plastic scrapers are used to reduce this wear. In the conventional conveyor, there is no provision made to keep the gravel in the concrete from being thrown out of the mix. This method keeps the entire mixture together at the point of discharge. **American Conveyor Company, 1115 West Adams St., Chicago 7, Ill.**

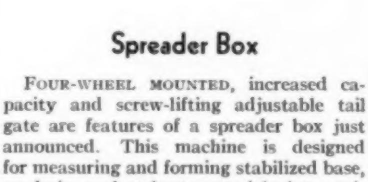
Equipment, Materials & Methods (Continued)

Versatile Grinding Machine

A MACHINE for grinding concrete ceilings known as the Giraffe, is now available. The versatile machine not only does away with uncomfortable masks, goggles and hand-rubbing stones, but also precludes the use of horses, planking, decking or scaffolds. The patented grinding head is fully adjustable, and various stones are available to suit different grinding needs. It will remove fins, ribs, and board marks on the concrete as well as nails used to secure light boxes, hangers, etc., to formwork before pouring. A $^3/_4$-hp Mall motor operates on 110-v AC or DC power and, turning at 3,450 rpm, is connected to the grinding head through a 7-ft flexible shaft. As in all Mall motor units, a 3-conductor wire is supplied to properly ground the machine. It's adjustable for heights from 7 to 9 ft and a twist of the turn-buckle changes pressures for various jobs. Only 28 in. wide, it will pass through doorways in existing buildings for modernization and renovation work. It's easily moved from floor to floor since total weight is only 148 lbs. **Concrete Grinding Corp., Dept. 14, 300 Straight St., Paterson, N. J.**

Spreader Box

FOUR-WHEEL MOUNTED, increased capacity and screw-lifting adjustable tail gate are features of a spreader box just announced. This machine is designed for measuring and forming stabilized base, roadmix or hotplant materials into uniform windrows. It meets the growing trend on the part of engineers to specify that materials dumped on the roadbed must be measured. The unit attaches directly to the dump truck and measures the materials as the truck moves along. The select or imported material flows from the truck through the adjustable gate of the spreader box and onto the base in one operation. Windrow capacities up to 8 cu ft are controlled by adjustable tail gate. The spreader box saves straightening up dumped materials which are unmeasured and eliminates guesswork by assuring controlled quantities of materials. **Wood Manufacturing Co., P. O. Box 620, 6900 Tujunga Ave., North Hollywood, Calif.**



Designed for Measuring Road Material

Equipment, Materials & Methods (Continued)

Surveying Instruments

A LINE OF MODERATE-PRICED surveying instruments, specifically designed to fill the needs of contractors and builders, has been introduced. Four instruments make up the "N" line; a convertible transit-level, heavy duty 12 in. dumpy level, service transit-level (farm level) and a hand level. The convertible transit-level

Dumpy Level

is designed for laying out and measuring horizontal and vertical angles, leveling, measuring differences in elevation, setting building lines, plumbing walls and columns. It has a 12 in. erecting-internal focusing, hard bronze telescope; rack and pinion adjustment; 22 power coated optics and steel spindle. Verniers read to 5 min. Leveling, clamp and tangent screws are dust protected. The heavy duty 12 in. dumpy level is suitable for setting grades and lines, measuring or laying off horizontal angles, running profiles, establishing foundation elevations. Features of this instrument are: 12 in. erecting-internal focusing, hard bronze telescope; rack and pinion adjustment; 22 power coated optics; steel spindle. Horizontal circle is graduated in single degrees, with vernier reading to 5 min. Leveling, clamp and tangent screws are dust protected. The service transit-level (farm level) was developed to meet the needs of the builder, farmer, landscape gardener and carpenter. It combines a 10 power, $10^1/_2$ in. erecting telescope, rack and pinion focusing, cross hairs in fixed focus and dust protected bearings. All parts of the hand level are permanently fitted and cannot go out of adjustment. It has stabilized internal focusing and an interior permanently mounted level vial. It is fully dust protected, $6^1/_2$ in. long and includes an attached neck cord. **C. L. Berger & Sons, Inc., 37 Williams St., Boston 19, Mass.**

When Requesting Literature, Please Tell The Manufacturers You Saw Their Products Mentioned in Civil Engineering

Equipment, Materials & Methods (Continued)

Combination Bulk Cement—Concrete Hauling Unit

THE NON-AGITATING concrete hauler, the Dumpcrete, is a new idea for a popular piece of contractor's equipment. A steel cover with loading hatch, is now available which easily attaches to this lightweight body to convert it into a bulk cement hauler. Contractors with quantities of concrete to pour where the batching and mixing plant is located away from a railroad siding, have found the Dumpcrete, with the removable bulk cement cover, to be fast, efficient and economical. When the need arises they can easily take off the cover and use the Dumpcrete for delivery and placement of concrete, as well as the hauling of sand, gravel, crushed stone and earth. **Manufacturing Division, Mazon Construction Company, Inc., 131 North Ludlow St., Dayton 2, Ohio.**

Drawing Instrument

THE "ORIGINAL LOTTER" parallel compass combines all the advantages of a straight compass, a giant bow and a beam compass (capable of drawing circles up to 26 in.) all in one instrument. The construction of the drawing instrument insures automatically, parallel opening of the lower legs of the compass to whatever degree the compass legs are opened, without being forced to curve the knees of the compass. Pen and pencil parts, therefore, always stand in best position to drawing paper, i.e., 90 degrees, working with or without self-contained lengthening bars. Due to the symmetrical shanks and the splendid balance of weight, and in combination with the micromatical adjustment, the parallel compass is the most modern drawing instrument in the world. It also has the famous "geared head" construction that assures years of trouble free use, and will never fall apart. A screw on the head of the compass firmly locks the instrument in any position, so that circles of the same diameter can be drawn over and over again without any deviation. **A. Partrick Company, 9 Grove St., Westwood, N.J.**

Multiple Shot Blasting Unit

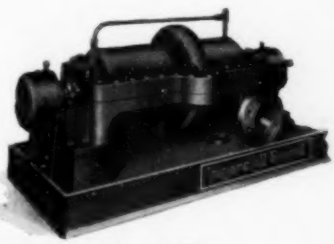
A MULTIPLE-SHOT blasting unit, said to incorporate improved firing action, safety and dependability in a compact and lightweight assembly, is being introduced. The MSA blasting unit weighs 1 lb., measures $2^1/_2$ in. $\times$ $2^1/_4$ in. $\times$ $4^3/_4$ in., is carried on the belt by means of a snap-on clip. It will fire up to 10 shots simultaneously. There is no danger of accidental firing, designers point out, as the wiring circuit is completely insulated from the battery container. And because the unit is capacitor-operated, the full charge is dissipated with each shot, eliminating misfires. The firing plug is equipped with brass contact terminals. Lead wires

Equipment, Materials & Methods (Continued)

are firmly held in the firing plug by spring-loaded retainers. When lead wires are inserted, and the firing plug pressed firmly into the battery container, a neon light glows at the top of the case to indicate a full charge in the capacitor. Release sends high voltage to detonate the charge. Ask for Bulletin No. 0901-1. **Mine Safety Appliances Company, Braddock, Thomas & Meade Sts., Pittsburgh 8, Pa.**

Centrifugal Pumps

THE REDESIGNED LINE of horizontal, multi-stage centrifugal pumps for medium-pressure applications, incorporates modern hydraulics that give higher efficiency and better operation. These pumps, called the Class CNTA, are intended for boiler-feed, mine dewatering, marine, refinery and general industrial



Class CNTA

services to 800 lbs. Built in $1^1/_2$, 2, $2^1/_2$ and 3 in. sizes, units are available with 4, 6 or 8 stages. The Class CNTA pump features a horizontally-split, smooth-bore cylindrical casing which contains the unit-type rotor assembly. This assembly is composed of the shaft, impellers, and channel rings, which contain the multiple-volute fluid passages. The entire rotor assembly is quickly and easily removed from and installed in the smooth-bore casing, since there are no mating ring fits or delicate alignment problems. A completely balanced rotor is assured through modern, multiple-volute design, which eliminates radial thrust at all conditions of operation. Back to back grouping of the impellers neutralizes axial thrust developed by the pressure differential across each individual stage. The same interstage sealing method successfully used in the higher pressure Class HMTA pumps is used in the CNTA line. This arrangement utilizes an alloy cast-iron or stainless-steel piston ring around the outer diameter of each individual channel ring. These hydraulic-type, step-seal rings have a metal-to-metal fit with the casing and are automatically placed under the correct compression when the casing halves are bolted together. They are highly resistant to corrosion and unaffected by high temperatures. **Ingersoll-Rand, 11 Broadway, New York 4, N. Y.**

Equipment, Materials & Methods (Continued)

Rust Preventative

PENETROL, USED for over fifty years in bulk by major steel, marine and bridge builders as a fine rust preventative, is now available in handy and efficient 12 oz. aerosol dispensers. It not only quickly and easily removes rust, but when sprayed on rust covered metal, joins with the rust to stop rust. This is the time saving feature of Penetrol, since the rust does not have to be removed. Oil paints, oil enamels, varnishes, and many synthetic coatings may be applied over Penetrol. It is used extensively for spraying on farm implements, trucks, and tractors to stop rust before storing for the winter or leaving outdoors for long periods of time. Also excellent on screens, gratings, gates, grills, railings, etc., where rust is a continual problem. **Reynolds Industries, Inc., 4500 Euclid Ave., Cleveland 3, Ohio.**

Reversible and Replaceable Cutter

OF INTEREST to operators of clamshell buckets in the excavating and heavy rehandling field, is a reversible and replaceable cutter recently announced. The unit replaces the old type, one piece tooth presently used. Similar in principle to the two-part tooth used so successfully in draglines and trenchers, the new tooth consists of a base which is permanently attached to the scoop, or lip, in the usual manner, and a reversible and renewable tip which fits into a slot and wedges itself into the base. Replaced in a fraction of the time required to install old style teeth, the unit not only reduces costly shut-down time but further effects savings by requiring only the replacement of that portion of the tooth which wears out. **Bucket Dept., Blaw-Knox Company, Farmers Bank Bldg., Pittsburgh 22, Pa.**

Liquid Level

A LIQUID LEVEL for attachment to the Adnun black top paver, is announced. This device gives positive leveling control for black top paving and the spreading of aggregate. It permits leveling up old road and will allow accurate correction for any slope at any station. It can hold a level grade without modifying the desired crown and will level up old shoulder and blend the course into an old crown. This simplifies the straightening up of old and wavy road by simple adjustment. All of this is made possible by the fact that the Adnun cutter bar screed is all in one piece and can be raised and lowered as a unit. The Adnun liquid level consists of reading glasses mounted vertically on the cutter bar supports. As these glasses are directly connected to each other the angle or movement of the cutter bar immediately affects the bubble in the reading glasses. This assures visual control of the level of the cutter bar at all times. **The Foote Company, Inc., Subsidiary of Blaw-Knox Company, Nunda, N.Y.**

Equipment, Materials & Methods (Continued)

Excavator and Truck Crane

A STANDARD AND HEAVY duty $^3/_4$ yd excavator and 20-ton truck crane, featuring power actuated drum clutches, direct right angle drive, optional hydraulic coupling and the new foundation borer attachment, has been announced. Operated by direct, extra-sensitive manual controls, the Gar Wood 75 uses the engine's power to engage the heavy duty clutches. Gar Wood's exclusive right angle drive, transmitting power through a universal coupling for lasting alignment, reduces

Model 75

fuel consumption by insuring the smoothest possible flow of power and eliminates the maintenance, noise, slack and backlash problems of chain drives. An optional hydraulic coupling absorbs the shock loads of rugged excavation and combined with the power actuated clutches and direct drive, retains the "feel" for the smoothest crane performance. Completely convertible in the field to shovel, crane, dragline, clamshell, trench hoe or pile driver, the Gar Wood 75 is also available as a completely convertible, factory installed foundation borer. This attachment which combines belling and boring into one operation has had wide acceptance in defense plant construction as it makes possible the use of cheaper, faster unreinforced footings. Other features include: all-welded, boxed-section machinery deck providing strength without dead weight; self-cleaning, non-clogging crawler tracts that reduce maintenance by minimizing the number of meshing parts; worm driven boom hoist with safety lock for absolute safety to men and machines; non-swaying, hooked conical rollers running in a double-flanged path; and effortless, instant vacuum controls for steering and dipper trip. In addition to the standard duty and heavy duty basic machines, the Gar Wood 75 is offered as a 20-ton truck crane, mounted on a rugged 6 x 6 or 6 x 4 chassis designed to meet the requirements of high mobility and extremely heavy service. **Gar Wood Industries, Findlay Division, Findlay, Ohio.**

When Requesting Product Information Please Mention Civil Engineering

Literature Available

EXCAVATOR OPERATION AND MAINTENANCE—A 32-page publication titled, "Ways to Make Your Excavator Work Harder—Live Longer," covers subjects close to any excavating man's purse. The time tested rules of excavator and crane operation and maintenance are listed and explained along with some new slants and tips on operation, lubrication, adjustments and preventive maintenance in the illustrated, two-color booklet. **Bucyrus-Erie Co., South Milwaukee, Wis.**

AIR CONDITIONING FOR CRANE CABS—A 24-page, illustrated bulletin describing a complete line of crane cab coolers and conditioners is available. Designed to maintain comfortable working conditions and to supply clean, pure air under virtually all atmospheric and temperature variations, Dravo crane cab coolers and conditioners are now available in several models to meet every requirement. Included in the bulletin are complete specifications for the various models and suggestions on where and how to use them. Ask for Bulletin No. 1301, **Dravo Corp., Air Conditioning and Combustion Dept., Dravo Bldg., Fifth and Liberty Aves., Pittsburgh 22, Pa.**

GENERAL PURPOSE MOTORS—Construction features, ratings and dimensions of open drip-proof (Type AP) and splash-proof (Type APWW) squirrel-cage induction motors in ratings of 1/2 to 100 horsepower are described in a bulletin. The motors are available with many special modifications such as totally enclosed, vertical mounting, flange mounting, and multi-speed construction. **Allis-Chalmers Mfg. Co., 1187 S. 70th St., Milwaukee, Wis.**

CRANE HOIST CONTROL—An 8-page booklet describes an a-c crane hoist control, Load-o-matic. In addition to the simplified operation explanation, other sections cover construction, mounting, and performance characteristics. Six sets of motor speed-torque curves show how Load-o-matic control compares with other forms of crane control in combination with a-c wound-rotor induction motors. Associated equipment such as the master switch, resistors, holding brake, and the contactors, are illustrated and described. Ask for booklet, B-5417, **Westinghouse Electric Corporation, Box 2099, Pittsburgh 30, Pa.**

MAINTENANCE GUIDE—An illustrated maintenance guide for No. 12, No. 112 and No. 212 motor graders has been released. The 24-page, cartoon-type, 4-color pamphlet points out that 99 percent of all Caterpillar motor graders are still at work and then goes on to explain that, despite quality and maximum service, life of the motor grader depends upon care given by its operator. The sketches and text then detail various adjustments that may be made, cautions to be taken in servicing and tips on such points as tire care. **Caterpillar Tractor Co., Peoria, Ill.**

Literature Available (Continued)

Industrial Gears—A 4-page folder, the first of its kind illustrating industrial and construction machinery driven by engines equipped with S-N industrial reduction gears, has been issued. It shows a few of their many possible applications including bridge-raising, pumping, dredging, quarrying, ditching, and sand pit dragging. **The Snow-Nabstedt Gear Corporation, 222 Welton St., Hamden, Conn.**

Concrete Curing Papers—Reinforced, waterproof papers meeting federal specifications are described in a colorful illustrated folder. Included are suggestions for re-use of these extra strong concrete curing papers for other construction needs. **Angier Corporation, Framingham, Mass.**

Soil Sampling—A comprehensive bulletin on the science of soil sampling, is offered. The bulletin represents a complete collection of data and information about soil sampling techniques accumulated during the past 33 years by the company. Modern sampling techniques are discussed along with recommendations as to correct tools and accessories best suited for economical recovery of samples. **Acker Drill Company, Inc., Scranton 3, Pa.**

Copyflex Process—An 8-page, two-color booklet describes the Bruning Copyflex process which is a quick, clean and odorless method for making copies of practically anything drawn, written, typed or printed. Ask for Booklet A-2008. **Charles Bruning Company Inc., 125 North St., Teterboro, N. J.**

Protective Coating—A 20-page booklet on Dum-Dum Masonoc, heavy "self-healing" protective coating, is available. Large illustrations showing restoration and protection of nineteen different types of masonry structures against attacks of wind, weather, fumes and heat constitute the greater portion of the book. Several "before-and-after" photos graphically demonstrate the material's possibilities in masonry restoration. A description of the application methods used by experienced Dum Dum appliers is included. **The Arco Company, 7301 Bessemer Ave., Cleveland 27, Ohio**

Prestressed Concrete Floor and Roof Slabs—A copy of the 1952 catalog on Flexicore prestressed concrete floor and roof slabs is available. Special features include: diagrams showing how Flexicore slabs are used with all types of construction; a simplified load chart; an explanation of how prestressing Flexicore slabs permits heavier loads on longer clear spans; new ways to install heating systems, including hot water radiant and a warm air split system that combines circulating air with a radiant floor. **The Flexicore Co., Inc., 1932 East Monument Ave., Dayton 1, Ohio**

Literature Available (Continued)

ZEOLITE SOFTENER BULLETIN—A revised edition of the bulletin on sodium zeolite softeners, known as Publication 4520-A, has just been issued. The bulletin gives a detailed explanation of zeolite water softening, including a glossary of terms used in the process, data for laying out a zeolite softening plant, the factors governing the size of equipment, the selection of zeolite materials and a detailed description of the four stages of operation of a sodium zeolite softener. A complete description of the hydromatic single control valve is included. **Cochrane Corporation, 3107 N. 17th St., Philadelphia 32, Pa.**

GENERAL LINE CATALOG—A general line catalog which provides a handy digest of all its current models, has been issued. The catalog, Book No. 2373, includes photographs and brief descriptions and applications of sixteen models of Link-Belt speeder equipment. Of particular interest is the listing of "master books" which contain complete data on each model to augment the thumbnail description contained in this general line catalog. **Link-Belt Speeder Corporation, 1201 Sixth St., S. W., Cedar Rapids, Iowa**

MOTORIZED HEAD PULLEY—A booklet featuring the Schrock motorized head pulley is offered. The booklet describes the pulley, tells where it's used, lists distinct advantages and shows typical installations. A belt speeds and pulley diameter table is also included. **Yuba Manufacturing Co., 351 California St., San Francisco 4, Calif.**

CONCRETE PIPE COATING—Bulletin R-2 describes completely the properties and uses of Rexon Coating No. 2, a chemically resistant concrete pipe coating. Specifically developed to protect concrete pipe against the chemical attack of sewage and industrial wastes, Rexon Coating No. 2 is virtually inert to all acids, alkalies, oils and solvents. Full details on the characteristics, working properties and methods of application of this air drying, self-vulcanizing coating are given in the 4-page, two color folder. **Hamilton Kent Mfg. Co., 225 Gougler Ave., Kent, Ohio**

GEAR QUALITY DATA—A paper which clarifies the data required to specify and test spur and helical gears, is offered in "A Practical Approach to Gear Quality." It refers to the standards developed for fine-pitch gears (20 D. P. and finer), but the ideas are applicable to gears of coarser pitch as well. Some of the subjects covered by the paper include specifications for gears, a definition of "class" and discussion of backlash, the analytical errors, and active versus inactive profiles. The paper is illustrated with several charts and diagrams which help to explain the principles involved. **Eastman Kodak Company, Industrial Optical Sales Div., Rochester 4, N. Y.**

PROCEEDINGS AVAILABLE

The following papers, printed as Proceedings Separates, may be ordered on the basis of summaries given in this and previous issues of CIVIL ENGINEERING. Discussions of these papers will be received, as in the past, for a period of five months following the date of issue. A summary of each paper appears in several consecutive issues; other titles will be added every month, as they become available. Use the convenient order form on page 112.

Summarized in Earlier Issues

119. **Thin-Walled Members in Combined Torsion and Flexures,** by Warner Lansing.

120. **Surface Water Wave Theories,** by Martin A. Mason.

121. **Rate of Change of Grade per Station,** by Clarence J. Brownell.

122. **Engineering Aspects of Diffraction and Refraction,** by J. W. Johnson.

D-59. Discussion of Paper, **Limit Design of Beams and Frames,** by H. J. Greenberg and W. Prager.

D-65. Discussion of paper, **National Topographic Mapping,** by W. E. Wrather.

D-71. Discussion of Paper, **Rectification of the Papaloapan River in Mexico,** by Reynaldo Schega.

123. **Long-Period Waves or Surges in Harbors,** by John H. Carr.

124. **Influence Lines by Corrections to an Assumed Shape,** by James P. Michalos and Edward N. Wilson.

125. **Torsion of Plate Girders,** by F. K. Chang and Bruce G. Johnston.

126. **Variation of Wind Velocity and Gusts with Height,** by R. H. Sherlock.

D-53. Discussion of Paper, **Wedge-Beam Framing,** by Arsham Amirikian.

D-72. Discussion of Paper, **Design of Large Coal Bunkers,** by Paul Rogers.

Third Notice

127. **Stresses in Deep Beams,** by Li Chow, Harry D. Conway, and George Winter.

128. **Horizontally Curved Box Beams,** by Charles E. Cutts.

129. **Analysis of Arch Dams of Variable Thickness,** by W. A. Perkins.

130. **Underground Corrosion of Piping,** by R. A. Brannon.

131. **The Allegheny Conference—Planning in Action,** by Park H. Martin.

132. **Specifications for Structures of a Moderate Strength Aluminum Alloy of High Resistance to Corrosion, Progress Report of the Committee of the Structural Division on Design in Lightweight Structural Alloys.**

D-66. Discussion of Paper, **Lateral Forces of Earthquakes and Wind,** by a Joint Committee of the San Francisco Section of ASCE, and the Structural Engineers Association of Northern California.

D-79. Discussion of Paper, **Stage Predictions for Flood Control Operations,** by Ralph E. King.

D-80. Discussion of Paper, **Mississippi River Valley Geology Relation to River Regime,** by Harold N. Fisk.

Second Notice

133. **Uplift in Masonry Dams: Final Report of the Committee on Masonry Dams of the Power Division, 1951.** Essentially a digest of information and practice, this report is presented as a statement on foundation uplift. Information aiding the designer to arrive at adequate assumptions as to uplift effects in dams is important. Prospects of alleviating the scarcity of this information in the near future are not very promising. However, available data are held to be adequate to warrant a report on this phase. (Available July 1.)

134. **Solution of an Hydraulic Problem by Analog Computer,** by R. E. Glover, D. J. Herbert, and C. R. Daum. This paper discusses the general conditions of the problem of flow distribution in a network of estuarine channels to which an analog computer model was applied. After developing the analog requirements, the model is described with emphasis on the electronic circuit that provides the required square-law resistance. The equations correlating electrical and hydraulic quantities are developed from the basic electrical and hydraulic relationships. Finally, the methods by which the required boundary conditions were duplicated are discussed. (Available July 1.)

135. **Application of Electronic Flow Routing Analog,** by Max A. Kohler. The Weather Bureau's electronic streamflow analog is shown to be an effective device for the preparation of river forecasts where the Muskingum storage equation is applicable. It is equally adaptable to the routing of flow from point to point along the stream or to the direct routing of effective rainfall (runoff). The basis for the circuit employed in the analog and the methods of operating the equipment is discussed briefly. The

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basis for a circuit design that would make analog routing applicable to virtually all cases is also discussed. (Available July 1.)

136. **Steady-State Forced Vibration of Continuous Frames,** by C. T. G. Looney. A method of analysis is described for the steady-state forced vibration of continuous frames. All members are considered as simply supported and the end slopes found by means of harmonic analysis. The geometrical discontinuity with adjacent members is corrected by periodic end moments by means of a distribution procedure. Adapted to this analysis, the distribution procedure is an analytical tool familiar to most structural engineers. (Available July 1.)

D-75. Discussion of Paper, **Base Course Drainage for Airport Pavements,** by A. Casagrande and W. L. Shannon. The original paper, published in June, 1951, described observations on a number of airfields, illustrating the principal causes for the saturation of base courses of airfield pavements. Discussers are: Edward S. Barber, D. P. Kyrnine, and A. Casagrande and W. L. Shannon. (Available July 1.)

D-76. Discussion of Paper, **Model Tests Using Low-Velocity Air,** by James W. Ball. The original paper published in June, 1951, presented the use of low-velocity air testing to solve flow problems pertaining to hydraulic conduit systems. Discussers are: David W. Appel and James W. Ball. (Available July 1.)

First Notice

137. **Construction of the Delaware Memorial Bridge,** by Homer R. Seely. This structure, crossing the Delaware River about two miles south of Wilmington, Del., and forming the southern gateway to the New Jersey Turnpike, takes its place as the world's sixth bridge in order of length of suspended span. The paper outlines the legislative steps leading up to the construction and briefly describes the building of the foundations. The procedures followed in spinning the cables and the erection of the superstructure are explained in more specific detail. (Available August 1.)

138. **The Value and Administration of a Zoning Plan,** by Huber Earl Smutz. The first half of the twentieth century has witnessed more beneficial progress than any other given period in the history of civilization. Undoubtedly the outstanding civic development during this half century has been the remarkable development and spread of city planning and zoning, particularly comprehensive zoning, in American cities. (Available August 1.)

139. **Nonlinear Electrical Analogy for Pipe Networks,** by Malcolm S. McIlroy. The labor involved in solving the simultaneous head-loss equations for a pipeline network is eliminated by an electric network analyzer composed of special nonlinear resistors. Analogies between hydraulic and electric quantities are explained, and values of useful constants are tabulated. Accuracy of the procedure is shown to be satisfactory. Results of analyzing a network by means of the nonlinear electric circuit are compared with results of rigorous algebraic solutions. (Available August 1.)

140. **Irrigation Water Rights in the Humid Areas,** by Howard T. Critchlow. In the eastern part of the United States, and especially in New Jersey, the practice of supplemental irrigation has been growing, resulting in increased competition for the use of water for all purposes in large centers of population and industrial development. To deal with this subject, the paper is divided into two parts—general description of present practice, and water rights. (Available August 1.)

141. **Effect of Entrance Conditions on Diffuser Flow,** by J. M. Robertson and Donald Ross. Flow studies of conical diffusers of 5-, $7^1/_2$-, and 10-deg total angles preceded by 20-, 5-, and 9-dia lengths of pipe are reported. Diffuser-area ratio was found to be the major geometric parameter governing the shape and extent of the boundary layer, and the initial boundary layer thickness was found to be as important as the diffuser angle. It is concluded that the only consideration affecting choice of diffuser geometry is the prevention of separation. Results are applied to the design of a large high-speed water tunnel. (Available August 1.)

D-86. Discussion of Paper, **Ground-Water Phenomena Connected with Spreading,** by Paul Baumann. The original paper, published in August 1951, described conservation by the diversion of clear stream flow to off-channel areas as practiced in Los Angeles County, California. Discussers are: David K. Todd, Max Suter, D. P. Krynine, and Paul Baumann. (Available August 1.)

D-87. Discussion of Paper, **Sewage Reclamation by Spreading Basin Infiltration,** by Ralph Stone and William F. Garber. The original paper, published in September 1951, discussed a field study at two test installations located at Whittier and Azusa, Calif. Discussers are: R. B. Krone, J. F. Thomas and Harvey F. Ludwig; A M Rawn and F. R. Bowerman; and Ralph Stone and William F. Garber. (Available August 1.)

D-92. Discussion of Paper, **Experimental Investigation of Fire Monitors and Nozzles,** by Hunter Rouse, J. W. Howe, and D. E. Metzler. The original paper, published in October 1951, described the design of a fixed monitor, a portable monitor, and a nozzle that will reduce flow turbulence to a practicable minimum. Discussers are: G. Halbronn; Pierre Oguey, and Marcel Mamin and François Baatard; John H. Arnold; and Hunter Rouse, J. W. Howe and D. E. Metzler. (Available August 1.)

D-96. Discussion of Paper, **Surface Curves for Steady Nonuniform Flow,** by Robert B. Jansen. The original paper, published in October 1951, presented a rapid method of determining the water surface curve for steady, varied flow in a prismatic open channel. Discussers are: Ivan M. Nelidov, J. C. Stevens, Maurice Bishap and H. E. Babbitt, K. C. Wu, J. Pietrkowski, and Robert B. Jansen. (Available August 1.)

D-100. Discussion of Paper, **Forced Vibrations of Continuous Beams,** by Edward Saibel and Elio D'Appolonia. The original paper, published in November 1951, presented the determination of the forced oscillations of a continuous beam caused by an exciting force. Discussers are: W. H. Hoppmann, and Edward Saibel and Elio D'Appolonia. (Available August 1.)

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